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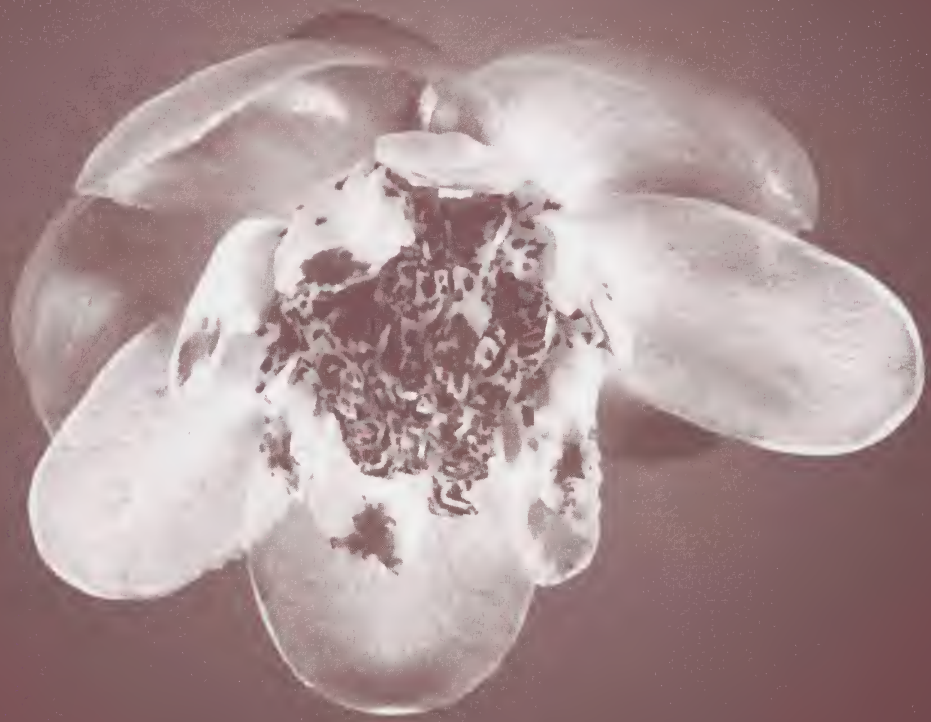

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Austrobaileya 9(4): 463–600 (2016)

Contents

A review of *Lagenophora* Cass. (Astereae: Asteraceae) in Queensland, Australia

Jian Wang & A.R. Bean

Summary

J.Wang & A.R.Bean (2016). A review of *Lagenophora* Cass. (Astereae: Asteraceae) in Queensland, Australia. ***Austrobaileya* 9(4): 463–480.** Five species of *Lagenophora* occur in Queensland. These include the two named species *L. gracilis* Steetz, a widespread and variable species; and *L. stipitata* (Labill.) Druce, known only in Girraween National Park. Three new species are here described; *L. queenslandica* Jian Wang ter & A.R.Bean, *L. fimbriata* Jian Wang ter & A.R.Bean and *L. brachyglossa* Jian Wang ter & A.R.Bean. All species are described and illustrated, with maps of their distribution provided. A key is provided to the Queensland species of *Lagenophora*. The conservation status of each species is assessed.

Key Words: Asteraceae, Astereae, *Lagenophora*, *Lagenophora brachyglossa*, *Lagenophora fimbriata*, *Lagenophora gracilis*, *Lagenophora queenslandica*, *Lagenophora stipitata*, Australia flora, Queensland flora, taxonomy, new species, identification key, illustrations, distribution maps

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Introduction

Lagenophora Cass. is a Gondwanan genus occurring in southern South America, New Zealand, New Caledonia, Australia and Malesia (Java, New Guinea), with one species extending to mainland Asia. All members of the genus are superficially similar, being herbaceous plants with mainly rosulate leaves; the scapes bear a single radiate capitulum, with white to mauve ligules.

In her revision of Australian *Lagenophora* (under the name *Lagenifera*), Davis (1950) accepted just two species for Australia, and only one (*L. stipitata* (Labill.) Druce) in Queensland. Her taxonomy was evidently strongly influenced by the conclusions of Bentham (1866), who similarly recognised just two species for Australia. Both Bentham (1866) and Davis (1950) regarded *L. gracilis* Steetz as a synonym of *L. stipitata*.

Cabrera (1966) in his revision of the genus considered that there are three species in Australia; *Lagenophora huegelii*, *L. stipitata* (with two varieties, var. *stipitata* and var. *montana*), and *L. gracilis*. He cited some *L. gracilis* specimens collected in Queensland, but did not record any other species from the state.

Stanley & Ross (1986) listed *L. gracilis* as the only species occurring in south-eastern Queensland, but in more recent years, several Queensland *Lagenophora* specimens lodged at BRI were identified as *L. stipitata*, and a single specimen from northern Queensland was given a phrase name, i.e. *Lagenophora* sp. (Forty Mile Scrub R.J.Fensham 1113), indicating it was believed to be an undescribed taxon (Holland & Bean 2015).

The current authors accept that both *L. gracilis* and *L. stipitata* occur in Queensland (the latter of very restricted distribution in the state), together with three new species described herein, viz. *L. brachyglossa*, *L. fimbriata* and *L. queenslandica*.

Lagenophora is closely related to *Solenogyne* Cass., a genus of very similar habit, but differing by the non-ligulate outer florets and the glabrous eglandular achenes without a beak. Drury (1974) determined that all *Solenogyne* species and the *gracilis* group of *Lagenophora* (*L. gracilis*, *L. huegelii* and *L. lanata*) form a taxonomic entity, which he suggested could be a section of *Lagenophora*.

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Recent molecular studies of these genera have supported Drury's thesis that *Lagenophora*, as currently circumscribed, is paraphyletic (Nakamura *et al.* 2012; Sancho *et al.* 2014). Monophyly could be restored by either making *Solenogyne* a synonym of *Lagenophora*, or by transferring the species of the *L. gracilis* group to the genus *Solenogyne*. The three species described here also belong to the *L. gracilis* group, and hence these may potentially be transferred to *Solenogyne*. However, no attempt has been made in this paper to alter the generic circumscription. We feel that more molecular markers need to be examined before a decision is made on the generic circumscription.

Materials and methods

This paper is based on morphological examination of *Lagenophora* material at BRI, and specimens received on loan from MEL and NSW. All species except *L. queenslandica* were examined in the field in 2014, 2015 and 2016. Three individuals of *L. queenslandica* from Shoalwater Bay and cultivated in Brisbane in 2016 were also examined. Most measurements are based on dried material, but the dimensions of florets are based on material preserved in 70% alcohol, or reconstituted with boiling water. Common abbreviations in the specimen citations are FR (Forest Reserve), NP (National Park), SF (State Forest).

Taxonomy

Lagenophora Cass., *Bull. Sci. Soc. Philom. Paris* 1816: 199 (Dec 1816) (*'Lagenifera'*) (*orth. cons.*). **Lectotype:** *Lagenophora billardierei* (=*L. stipitata*), *fide* A. Cunningham (1839:126).

Small perennial herbs, with stolons or rhizomes. Stem rudimentary or occasionally elongated. Basal leaves rosulate or occasionally alternate, obovate or oblanceolate, penninerved, dentate to lobed. Scapes unbranched, ribbed when dry, with leafy bracts scattered throughout. Head solitary, radiate. Involucre campanulate to hemispherical with 2–4(–6) rows of involucral bracts; bracts herbaceous, linear-lanceolate to oblanceolate, acute to obtuse, with narrow, scarious margins. Ray florets in 2–5 rows, pistillate, ligulate, white to purple. Disk florets bisexual but functionally male, with 5-dentate, tubular corolla. Anthers obtuse at base. Style 2-branched, papillose on the outer surface. Receptacle flat to hemispherical, glabrous. Achenes laterally flattened, obliquely obovate to oblanceolate or lunate, with thickened margins, and with a short to long glandular beak. Pappus absent.

17 species in Australia, New Caledonia, Malesia (Java, New Guinea), New Zealand, South America and Asia. Five species in Queensland.

Key to the Queensland species of *Lagenophora*

1 Plant usually with stolons (roots fibrous); roots not bunched; scape hirsute, retrorse to patent; mature achene dark or reddish brown **(Fig. 9 (1))** . . . . **1. L. stipitata**
1. Plant with rhizome only (roots fleshy); roots usually bunched; scape hairs appressed, antrorse; mature achene light brown or yellowish brown **2**

2 Leaves glabrous on surface but with fimbriate margins; involucre more than 1 cm diameter with 52–62 disc florets, ligule > 3 mm long . . . . . **4. L. fimbriata**
2. Leaves usually more or less hairy; involucre up to 1 cm diameter with 10–30 disc florets; ligule < 3 mm long **3**

3 Ligule 0.4–0.6 mm long; achene 3.2–3.7 mm long excluding beak . . . **5. L. brachyglossa**
3. Ligule 1.5–3.5 mm long; achene 2–3 mm long excluding beak **4**

4 Achene glands confined to dorsal side of beak and adjacent area of body (**Fig. 2**); achene usually with one to few hairs at base; achene beak 0.4–0.6 mm long, with a thickened white annular collar at its apex . . . . **2. L. gracilis**

4. Achene glands extending from distal end to base, especially along dorsal side; hairs absent from base of achene; achene beak usually 0.2–0.3 mm long, without a thickened white annular collar at its apex . . . . . **3. L. queenslandica**

1. Lagenophora stipitata (Labill.) Druce, *Rep. Bot. Soc. Exch. Club Brit. Isles* 4: 630 (1917); *Bellis stipitata* Labill., *Nov. Holl. Pl. Sp.* 2: 55, t. 205 (1806); *Lagenophora billardierei* Cass., *Dict. Sci. Nat. ed. 2*, 25: 111 (1822), *nom. illeg.*; *Lagenophora stipitata* var. *stipitata*, Domin, *Biblioth. Bot.* 89: 653 (1929). **Type:** Tasmania. "Habitat in capite Van-Diemen", in 1792 or 1793, *J.H.H. de Labillardière s.n.* (lecto: FI 006144 [here chosen]; isolecto: M 0029701, P 00742956).

Herb with stolons, roots wiry, not bunched, 0.1–1 mm diameter; stems to 23 cm long. Leaves 5–20, narrowly obovate to spathulate, 1.5–7.7 cm long, 0.4–1.8 cm wide (3.8–4.3 times longer than wide), sessile or with a winged petiole to 2 cm long, apex obtuse, margins sinuate, with 5–15 lobes, each 1–3 mm long. Upper leaf surface green, with 7–9 eglandular hairs per mm^2, each 0.2–0.35 mm long. Lower leaf surface pale green, with 7–9 eglandular hairs per mm^2, each 0.2–0.35 mm long. Leaf margins with 10–15 eglandular hairs per mm^2, each 0.2–0.3 mm long. Scapes 1–5 per plant, each 4–15 cm long at anthesis, 5–19 cm long at fruiting stage, 0.5–1.2 mm diameter, with 1–3(–5) bracts, each up to 8 mm long, *c.* 1 mm wide. Scape indumentum dense at midpoint (2–10 hairs per mm), equally dense throughout or denser towards apex; hairs spreading or retrorse to patent, 0.2–0.4 mm long. Involucre *c.* 6 mm long, 8–12 mm diameter; involucral bracts 50–60 in 5–6 rows, outer bracts shorter than the inner bracts, linear to narrow lanceolate, entire, apex acute to occasionally acuminate; inner bracts *c.* 3.5 × 0.4 mm, outer bracts *c.* 2.1 × 0.3 mm, all with hairs along the midrib. Receptacle hemispherical, 2–3.2 mm diameter and 1.2–1.5 mm long. Ray florets 40–70, in 2–4 rows, female; tube 0.7–0.9 mm long, *c.* 0.3 mm diameter with minute hairs; stigma 2–branched, each branch *c.* 0.5 mm long; ligule 2.3–3.3 mm long, 0.3–0.5(–0.8) mm wide, with 3 longitudinal veins, blue, purple or light yellow. Disc florets *c.* 15, functionally male, corolla yellow-green, tube 2–2.5 mm long, outer surface glandular near base part and short hairy near apex; lobes 5, deltate, purplish brown, 0.2–0.3 mm long, with minute hairs. Achenes obliquely oblanceolate, laterally compressed, 2.2–3 × 0.7–0.9 mm excluding beak, dark or reddish brown at maturity, with glands extending from distal end to base, especially along dorsal edge, but mainly basal and near apex; hairs absent from base of achene; achene beak 0.6–1 mm long, 0.15–0.25 mm wide, densely glandular throughout, with a thickened white annular collar at its apex, 0.25–0.3 mm diameter. **Figs. 1, 9(1).**

***Additional selected specimens examined*: Queensland.** Darling Downs District: Head of Racecourse Creek, Girraween NP, Mar 2009, *Holmes 245 & Holmes* (BRI); 250 m south of "L" junction, Girraween NP, Jan 2016, *Bean 32691 & Wang* (BRI, MEL); between "K" junction and "L" junction, Girraween NP, Jan 2016, *Bean 32695 & Wang* (BRI, NSW); "Z" junction, Girraween NP, just west of Bald Rock, Jan 2016, *Bean 32719 & Wang* (BRI). **New South Wales.** Northern Tablelands District: Upper slopes of Bald Rock, Bald Rock NP, N of Tenterfield, Dec 2015, *Bean 32542* (BRI); Warra SF, E of Llangothlin at Crown Mountain FR entrance, Feb 1995, *Hunter 2715 et al.* (BRI). Central Coast District: Macquarie Pass NP, SW of Wollongong, Dec 2000, *Bean 17159* (BRI). **Victoria**. Wilsons Promontory NP, dunes in the NW corner, Nov 1980, *Heyligers 80184* (MEL).

***Distribution and habitat*:** *Lagenophora stipitata* is a widespread species occurring in New South Wales, Queensland, South Australia, Tasmania and Victoria. In Queensland, it is confined to Girraween National Park, and within that park, it occurs only in the higher altitude and higher rainfall areas (**Map 3**). It has also been reported from near Auckland in New Zealand (Drury 1974).

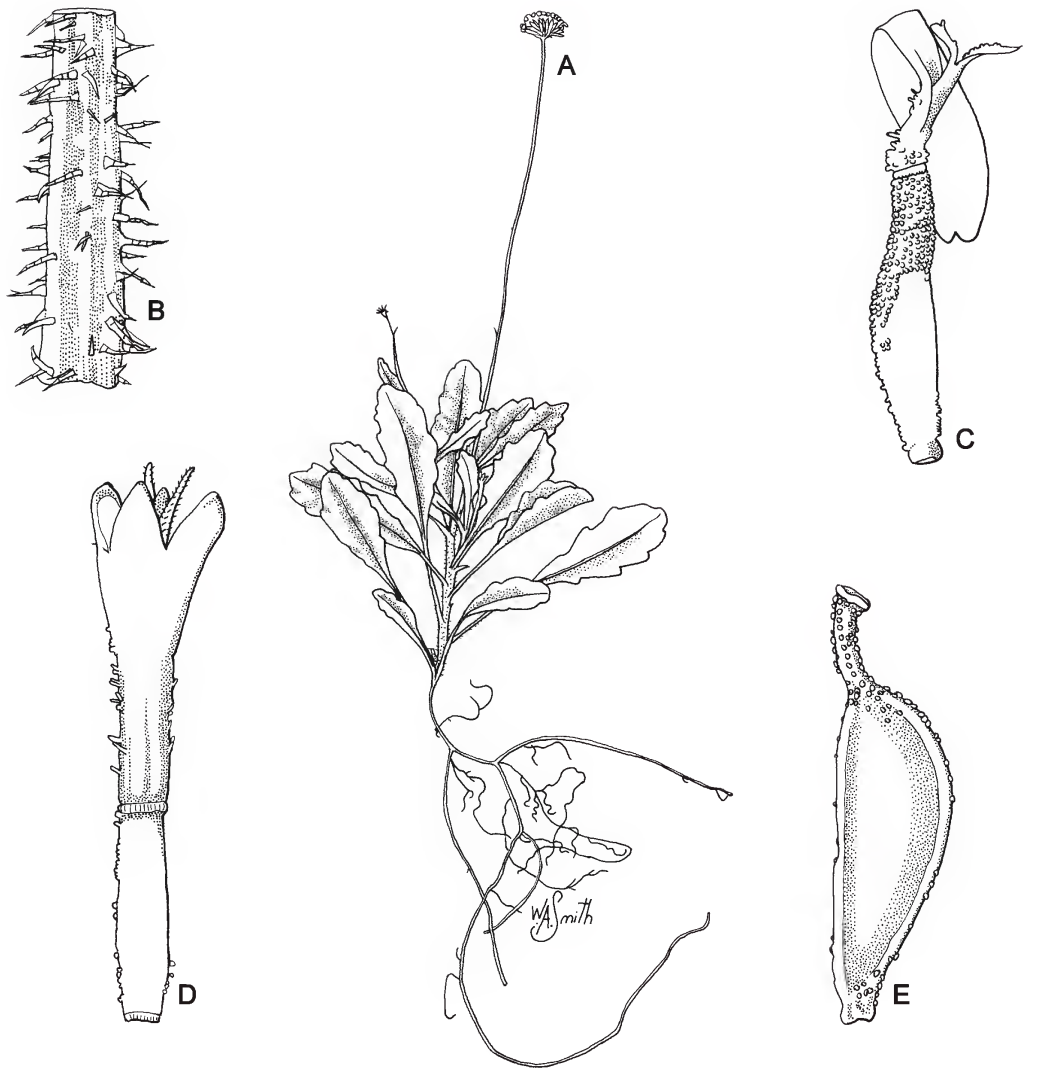

Fig. 1. ***Lagenophora stipitata.*** A. habit of whole plant with flowering and fruiting inflorescences ×0.5. B. mid-section of scape ×16. C. marginal floret ×16. D. disc floret ×16. E. achene ×16. A from *Bean 32695 & Wang* (BRI); B–E from *Bean 32719 & Wang* (BRI). Del. W. Smith.

Its habitat in Queensland is tall wet sclerophyll forest dominated by *Eucalyptus campanulata* R.T.Baker & H.G.Sm. and *E. deanei* Maiden, with an understorey of *Acacia* spp. and various ferns. *Lagenophora stipitata* may co-occur with *L. gracilis* in Queensland.

***Phenology*:** In Queensland, flowers are recorded in January and March; fruits in January and March. In New South Wales, South Australia, Tasmania and Victoria, the species flowers from September to March and fruits from November to April.

***Typification*:** It can be argued that Davis (1950) did not choose a lectotype for *Bellis stipitata*. Although she discussed the sheet that is here designated as the lectotype, she referred to it as a "syntype series" presumably as it consists of 11 elements, but according to the Code of Nomenclature (McNeill *et al.* 2011) it is to be regarded as a single specimen.

***Conservation status*:** Although *Lagenophora stipitata* is so far recorded from only two locations in Girraween National Park, it has a wider distribution in the southern states of Australia. Therefore, it is not considered to be threatened and a **Least Concern** conservation status is recommended based on the IUCN (2012) criteria.

2. Lagenophora gracilis Steetz in Lehmann, *Plantae Preissianae* 1: 431 (1845). **Type:** Western Australia. King George Sound, *J.S. Roe s.n.* (?W, *n.v.*).

Herb with rhizomes, roots fleshy, bunched, 0.5–1.5 mm diameter; stem absent or up to 5 mm long. Leaves 4–16, obovate, oblanceolate or elliptical, 2–9 cm long, 0.8–2.2 cm wide (2.5–4.1 times longer than wide), sessile or with a winged petiole to 1 cm long, apex obtuse, margins finely serrate or dentate, with 5–19 teeth, each 0.2–2 mm long. Upper leaf surface green, with 0–7 eglandular hairs per mm^2, each up to 0.3 mm long. Lower leaf surface pale green, with 0–8 eglandular hairs per mm^2, each up to 0.3 mm long. Leaf margins with 5–12 eglandular hairs per mm^2, each 0.2–0.4 mm long. Scapes 1–7 per plant, each 4–19 cm long at anthesis, 6–31 cm long at fruiting stage, 0.5–0.6 mm diameter, with 1–6 bracts, each 1–10 × 0.2–0.5 mm. Scape indumentum of 2–10 hairs per mm at midpoint of scape, rather more dense towards apex; hairs antrorse, more or less appressed, *c.* 0.1 mm long. Involucre 4–5(–6) mm long, 6–8(–11) mm diameter; involucral bracts 20–40 in 3–5 rows, glabrous, outer bracts shorter than the inner bracts, oblong to obovate, apex obtuse, with fringed margin on distal part, inner bracts 2.1–2.6 × 0.5–0.7 mm, outer bracts 1.2–1.9 × 0.3–0.6 mm. Receptacle hemispherical, *c.* 2.7 mm diameter and *c.* 1 mm long. Ray florets 20–37 in 2–5 rows, female; tube *c.* 0.5 mm long × 0.1–0.15 mm diameter, with minute hairs; stigma 2–branched, each branch 0.3–0.4 mm long; ligule 2.1–2.2 mm long, 0.3–0.4 mm wide, white to mauve. Disc florets 10–20, functionally male, corolla light yellow, tube 1.5–1.9 mm long, outer surface with sparse minute hairs; lobes 5, deltate, 0.1–0.2 mm long. Achenes obliquely oblanceolate, laterally compressed, 2.4–2.8 × 0.6–0.8 mm excluding beak, light brown to brown at maturity, with glands confined to dorsal side of beak and adjacent area of achene; 1–3 hairs usually present at base of achene; achene beak 0.4–0.6 mm long, with a thickened white annular collar at its apex, 0.2–0.25 mm diameter. **Figs. 2, 9(2)**.

***Additional selected specimens examined*: Queensland.** Cook District: Speewah, upper Clohesy River, Mar 1948, *Brass 18215* (BRI); Daintree NP, Adeline Creek headwaters, ridge to Hill 929, May 1999, *Forster PIF24527 & Booth* (BRI, MEL); Hann Tableland, NW of Mareeba, May 2004, *McDonald KRM2465 & Ford* (BRI); 11.5 km NW of Mt Molloy, Gnana Kukul trail, slopes of Mt Lewis/Fraser, Brooklyn, Jun 2007, *Kemp JEK10208 & Kutt* (BRI). North Kennedy District: SF 511, NW of Ravenshoe, Mar 2004, *McDonald KRM1800* (BRI); Taravale near Hell Hole Creek, 0.5–1 km E of homestead, Mar 1987, *Jackes 8703* (BRI); Lot 5, Webster Road, S of Wondecla, Apr 2004, *McDonald KRM2112* (BRI); Kirrama SF, Mar 1985, *Crowley 7* (BRI). South Kennedy District: Schumanns Road, *c.* 1.1 km E of Swampy Ridge radar installation, W Eungella, Jun 1995, *Pollock 238* (BRI); Snake Road, SF 62, at locked gate, NE of Eungella township, Feb 2003, *Bean 20045* (BRI). Leichhardt District: Blackdown Tableland, *c.* 32 km SE of Blackwater, Apr 1971, *Henderson 629 et al.* (BRI); Carnarvon Gorge, Carnarvon NP, NW of Injune, Apr 1994, *Morley s.n.* (BRI [AQ471673]); SF 35, Bigge Range, NW of Taroom, Nov 1998, *Forster PIF23920 & Booth* (BRI). Port Curtis District: On upper ridge but below final peak, Mt Larcom, Mar 1966, *Curtis s.n.* (BRI [AQ930489]); 10 km SE of Forestry Camp, Kroombit Tops, Dawes Range, 64 km SW of Calliope, Dec 1983, *Sharpe 3421* (BRI); 17.5 km NW of Gladstone, Apr 1997,

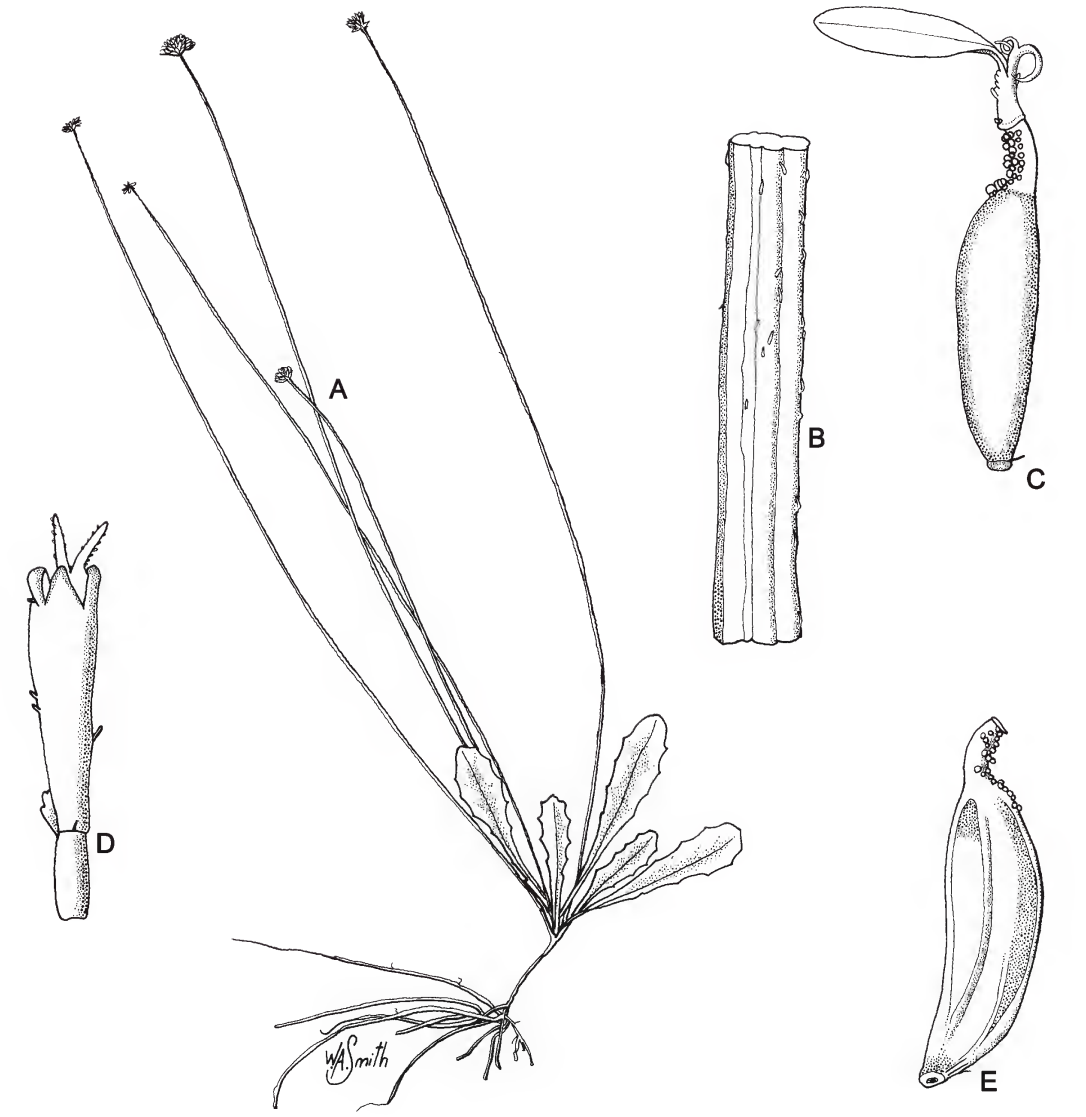

Fig. 2. ***Lagenophora gracilis***. A. habit of whole plant with flowering and fruiting inflorescences ×0.5. B. mid-section of scape ×16. C. marginal floret ×16. D. disc floret ×16. E. achene ×16. A from *Bean 19040* (BRI); B–D from *Bean 32689* (BRI); E from *Bean 32713* (BRI). Del. W. Smith.

Thompson GLA67 (BRI). Burnett District: Bania SF, N of Mt Perry, Mar 1995, *Bean 8500* (BRI); Gorge Oaky LA, Coominglah SF, NW of Monto, Jun 1996, *Bean 10416* (BRI). Wide Bay District: Groggee Mt, Main Range, about 20 km S of Glastonbury, near Gympie, Apr 1978, *Sharpe 2330* (BRI); Ridge running E of Como Scarp Road, Cooloola NP, Mar 1986, *Sandercoe 660* (BRI); Compartment 56A, just S of Benarige Creek track junction, SF 57, Parish of St Mary, Mar 1995, *Grimshaw 2041* (BRI). Darling Downs District: Mt Colliery area off Gambubal Road, 'Paddy's Gully' adjacent to Main Range NP, Apr 2015, *Forster PIF42568 et al.* (BRI); 170 metres E of "L" junction, Girraween NP, Jan 2016, *Bean 32689 & Wang* (BRI); "Z" junction, Girraween NP, just W of Bald Rock, Jan 2016, *Bean 32713 & Wang* (BRI). Moreton District: Diana's Bath area, near Mt Byron, D'Aguilar Range, May 1995, *Forster PIF16479 & Figg* (BRI); Mt Marysmokes, Bellthorpe SF, NW of Woodford, Dec 1998, *Bean 14392* (BRI); Kobble Creek, *c.* 3.5 km from Hawkins Road, Samsonvale, Apr 2003, *Phillips 1088 & Phillips* (BRI); Johnson Road, 2 km W of Browns Plains, May 2002, *Bean 19040* (BRI).

***Distribution and habitat*:** *Lagenophora gracilis* is widely distributed, occurring in Asia (e.g. India, Thailand), Malesia (e.g. Java, New Guinea), and Australia (New South Wales, Queensland, South Australia, Tasmania, Victoria and Western Australia). In Queensland, it is found from the NSW border to Gladstone, and a few places further west e.g. Blackdown Tableland, Carnarvon Gorge, then disjunctly further north, e.g. the Eungella plateau near Mackay, between Paluma and Daintree NP, NW of Mossman (**Map 1**). It mainly inhabits eucalypt or *Melaleuca* dominated open forest or woodland on a wide range of soils. It frequently occurs at altitudes exceeding 500 metres, but in the south-east of the state, it may be found near sea level.

***Phenology*:** In Queensland, although flowers and fruits are recorded mainly from November to April, there is a record of flowers in September and fruits in June.

***Notes*:** *Lagenophora gracilis* is a widespread and highly variable species. Its taxonomy and nomenclature will be studied in a future paper. The type of *L. gracilis* has not been located. It was expected to be at W, but recent searches there (A. Löckher, pers. comm.) have failed to reveal it.

***Conservation status*: Least Concern** (IUCN 2012).

3. Lagenophora queenslandica Jian Wang ter & A.R.Bean **sp. nov.** with affinity to *L. gracilis*, but differing by the longer hairs on the leaves, the oblong to obovate involucral bracts, and the beak on the achene being shorter and lacking the white annular collar at its apex. **Typus:** Queensland. Cook District: 3 km from Mt Molloy on Mareeba road, 12 April 1975, *L.A.Craven 3243* (holo: BRI; iso: CANB *n.v.*).

Lagenophora sp. (Forty Mile Scrub R.J.Fensham 1113); Holland & Bean (2015).

Herb with rhizomes, roots fleshy, bunched, 0.8–2 mm diameter; stem absent or to 5 mm long. Leaves 4–14, oblong, obovate or elliptical, 2.5–8 cm long, 1.2–2.4 cm wide (2.1–3.3 times longer than wide), sessile or with a winged petiole to 1 cm long, apex obtuse, margins finely serrate or dentate, with 9–17 teeth, each 0.5–1.5(–2) mm long. Upper leaf surface green, with 0–2 eglandular hairs per mm^2, each 0.3–0.5 mm long. Lower leaf surface pale green, with 0–3 eglandular hairs per mm^2, each 0.3–0.6 mm long; up to 7 eglandular hairs per mm^2 along the midvein. Leaf margins with 5–7 eglandular hairs per mm^2, each 0.1–0.4 mm long. Hairs much longer to 1 mm or more at leaf base. Scapes (1–)3–8 per plant, each 9–17 cm long at anthesis, 11–25 cm long at fruiting stage, 0.6–1.2 mm diameter, with 2–6 bracts, each up to 8 × 1.4 mm. Scape with 4–7 hairs per mm at midpoint, rather more dense towards apex; hairs antrorse, more or less appressed, *c.* 0.05 mm long. Involucre 4–5 mm long, 6–9 mm diameter; involucral bracts 20–40 in 2–4 rows, glabrous, outer bracts shorter than the inner bracts, oblong to obovate, apex obtuse, with fringed margin on distal part, outer bracts 1–1.6 × 0.4–0.6 mm, inner bracts *c.* 2.1 × 0.5–0.7 mm. Receptacle hemispherical, *c.* 2.7 mm diameter and *c.* 1 mm long. Ray florets 30–40, in 2–5 rows, female; tube *c.* 0.5 mm long, *c.* 0.2 mm diameter, with minute eglandular hairs; stigma 2-branched, each branch 0.3–0.5 mm long; ligule 1.4–1.8 mm long, 0.3–0.4 mm wide, white to mauve. Disc florets 18–30, functionally male, corolla light yellow, tube 1.7–1.8 mm long, outer surface with minute eglandular hairs; lobes 5, deltate, 0.1–0.3 mm

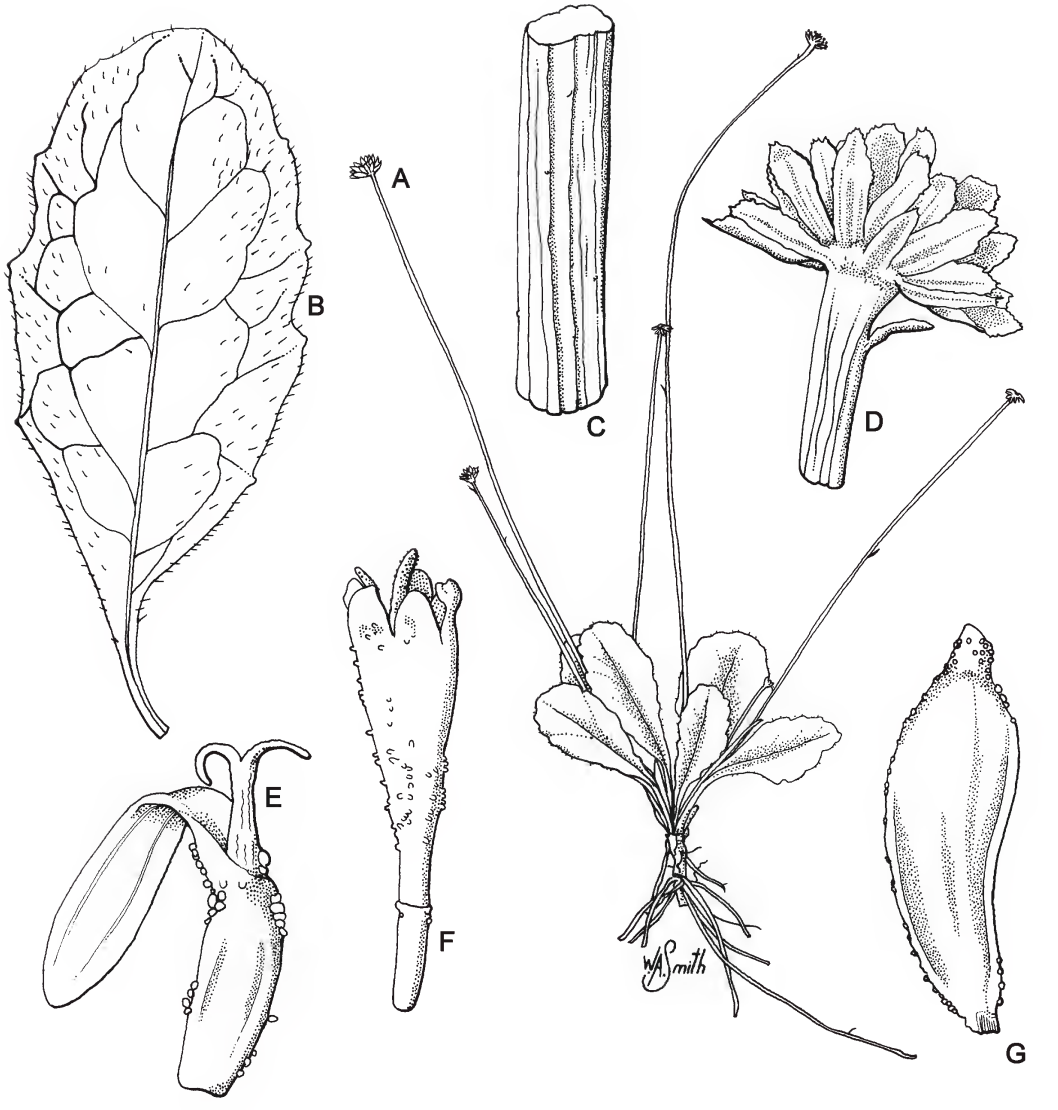

Fig. 3. ***Lagenophora queenslandica.*** A. habit of whole plant with flowering and fruiting inflorescences ×0.6. B. adaxial leaf surface ×2. C. mid-section of scape ×8. D. capitulum with flowers and fruits removed, lateral view ×6. E. marginal floret ×24. F. disc floret ×16. G. achene ×16. A & E from *Halford QM939* (BRI); B & D from *Champion 1033 et al.* (BRI); C, F & G from *Bean 11955* (BRI). Del. W. Smith.

Fig. 4. Flowering head of ***Lagenophora queenslandica*** (*Mathieson MTM2348*, BRI). Photo: M.T. Mathieson.

long; sterile ovary 0.6–0.9 mm long. Achenes obliquely oblanceolate, laterally compressed, 2–3 × 0.6–1.2 mm excluding beak, light brown to brown at maturity, with glands distributed from distal end to base, especially along dorsal edge; hairs absent from base of achene; achene beak 0.2–0.3 (–0.4) mm long and 0.2–0.3 mm wide, densely glandular throughout, lacking a thickened white annular collar at its apex. **Figs. 3, 4, 9(3).**

***Additional selected specimens examined*: Queensland.** Cook District: Portland Roads, Jun 1948, *Brass 18995* (BRI); Byerstown Range, Feb 2016, *McDonald KRM17663* (BRI); Brooklyn H near Rifle Creek/Luster Creek junction, Jan 1996, *Godwin MGC4202 & Russell* (BRI); 9.1 km from Forsayth pub along Einasleigh Road, near Mt Talbot turnoff, Feb 2011, *McDonald KRM10591* (BRI); 19 km E of Kennedy Highway along Tinaroo Creek Road, 0.9 km W of road junction, Apr 2003, *Neldner 4206* (BRI); 500 m W of MBA [Mareeba] – Mt Molloy Road opp. Hodzic Road, Mar 2002, *Thompson SLT2563 & Newton* (BRI); E of Cobra Creek between Tinaroo Falls & Malone Road turnoff on Cairns Road, Feb 1962, *Webb 5875 & Tracey* (BRI). North Kennedy District: Forty Mile Scrub NP, Mar 1993, *Fensham 1113* (BRI); 37.4 km by road to Princess Hills, from junction with Kennedy Highway near Mt Garnet, Jan 2005, *McDonald KRM3589* (BRI); White Mountain NP near Warang, Apr 2000, *Wannan 1747* (BRI, NSW, MEL). Leichhardt District: Homevale Station, adjacent to paddock fence line track, 3.5 km W of station, Mar 1994, *Champion 1033 et al.* (BRI). Mitchell District: Warang, WNW of Torrens Creek, Apr 1990, *Cumming 9662* (BRI). Port Curtis District: Eden Bann Road, W of Canoona, Mar 1994, *Bean 7541* (BRI); Neerkool Creek, *s.dat.*, *Bowman s.n.* (MEL 2161644); 1.5 km SW along East–West Road from junction with Elanora track, Razorback Sector, Shoalwater Bay Training area, Feb 2014, *Halford QM939* (BRI); The Springs Sector, Shoalwater Bay Training Area, Dec 2015, *Mathieson MTM2348* (BRI). Burnett District: SF 43, 16.6 km along Hawkwood Road, SW of Mundubbera, Apr 1997, *Bean 11955* (BRI); Near regrowth experiment, Narayen, Nov 1969, *s. coll.* (BRI [AQ583268]).

***Distribution and habitat*:** *Lagenophora queenslandica* is endemic to central and north Queensland. Most records are from coastal and near-coastal areas from Mareeba to Rockhampton, but there are several

occurrences further inland, e.g. White Mountains near Pentland, near Mundubbera, and Springsure. There is also a record from Portland Roads on Cape York Peninsula (**Map 2**). The species usually inhabits *Eucalyptus* open forests and *Melaleuca* woodlands on ridges or alluvial plains. There is also a record from dry rainforest on basalt soil.

***Phenology*:** Flowers and fruits are mostly from January to April. However, there are also records of flower or fruits in October, November, May and June.

***Notes*:** *Lagenophora queenslandica* is of similar appearance to the parapatric *L. gracilis*, but differs by the leaves more consistently obovate (leaf length/width ratio 2.1–3.3 versus 2.5–4.1 for *L. gracilis*); the shorter and broader involucral bracts; the lack of hairs at the base of the achene; the glands on the achene beak distributed throughout (confined to the dorsal side in *L. gracilis*), and the achene beak only 0.2–0.3(–0.4) mm long (0.4–0.8 mm long for *L. gracilis*), and without the thickened white annular collar at its apex.

***Conservation status*:** *Lagenophora queenslandica* is an occasional or rare species according to collecting notes. However, it is widespread from central-coastal Queensland to the Cape York Peninsula. Therefore, a **Least Concern** conservation status is recommended using the IUCN (2012) criteria.

***Etymology*:** The specific epithet is derived from the state of Queensland in north east Australia. It indicates the general occurrence of this new species.

4. Lagenophora fimbriata Jian Wang ter & A.R.Bean **sp. nov.** with affinity to *L. gracilis*, but differing by the glabrous leaf surface, the fimbriate leaf margin, the larger involucre, the longer ligules, the more numerous (at least twice as many) disc florets, and the glands on the achene distributed along dorsal edge from beak to near base. **Typus:** Queensland. Moreton District: Purga Nature Reserve, 14 km SSW of Ipswich, 1 December 2015, *A.R. Bean 32442 & J. Wang* (holo: BRI; iso: BM, CANB, CHR, MEL, NSW, P, US).

Herb with rhizomes, roots fleshy, bunched, 1–2 mm diameter; stem absent or to 5 mm long. Leaves 5–16, oblanceolate, 4–15 cm long, 0.8–2.7 cm wide (5–5.6 times longer than wide), sessile or with a winged petiole to 4 cm long, apex obtuse, margins finely toothed, with 9–23 teeth, each 0.2–1 mm long. Upper leaf surface dark green, glabrous. Lower leaf surface pale green, glabrous. Leaf margins with 3–4 eglandular hairs per mm^2, each *c.* 0.3 mm long. Scapes (1–)3–7 per plant, each 10–20 cm long at anthesis, 14–38 cm long at fruiting stage, 0.6–1.2 mm diameter, with 3–7 bracts, each 10–18 × 0.5–2 mm. Scape indumentum very sparse at midpoint of scape (2–5 hairs per mm), rather more dense towards apex; hairs antrorse, more or less appressed, 0.05–0.1 mm long. Involucre 6–10 mm long, 11–14 mm diameter; involucral bracts 24–28 in 2–3 rows, glabrous, outer bracts shorter than the inner bracts, oblong to obovate, apex obtuse, with fringed margin on distal part, outer bracts 1.6–2.1 × 0.6–0.7 mm, inner bracts 2.5–3.5 × 0.7–1 mm. Receptacle hemispherical, *c.* 2.0 mm diameter and *c.* 1 mm long. Ray florets 40–50, in 2 rows, female; tube *c.* 1 mm long and *c.* 0.3 mm diameter with minute hairs; stigma 2-branched, each branch *c.* 0.5 mm long; ligule 3–4.7 mm long, 0.5–1.1 mm wide, white to mauve. Disc florets (46–)52–62, functionally male; corolla light yellow; tube 2–2.8 mm long, outer surface with minute hairs; corolla lobes 5, deltate, 0.3–0.4 mm long; sterile ovary 1–1.5 mm long. Achenes obliquely oblanceolate, laterally compressed, 2.8–3.2 × 0.8–1 mm excluding beak, light brown to brown at maturity; achene glands mostly confined to dorsal edge, the density gradually reducing from apex to base; hairs absent from base of achene; achene beak (0.2–)0.4–0.5(–0.7) mm long, densely glandular on dorsal side, sparsely glandular elsewhere, with a white annular collar at its apex, 0.2–0.3 mm diameter. **Figs. 5, 6, 9(4).**

***Additional selected specimens examined*: Queensland**. Burnett District: E side of road Bungaban, Auburn Range, *c.* 6.2 km N of Dawson Vale E along road to Rockybar, Mar 1997, *Pollock ABP450 & Baumgartner* (BRI). Borania SF, S of the Eidsvold – Theodore Road, Apr 2015, *Forster PIF42379 & Thomas* (BRI). Darling Downs District: Inglewood, Mar 1911, *Boorman s.n.*

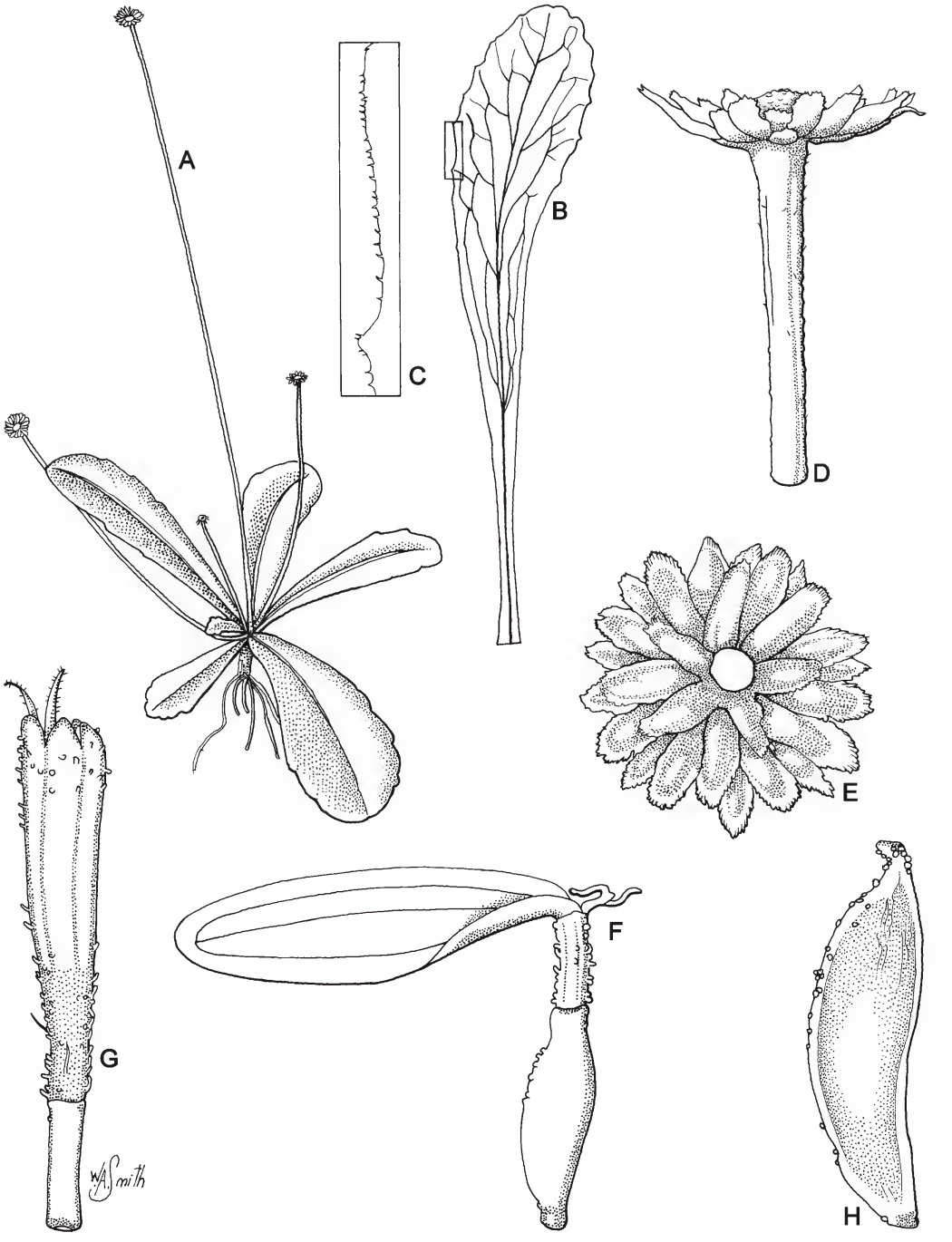

Fig. 5. ***Lagenophora fimbriata.*** A. habit of whole plant with flowering and fruiting inflorescences ×0.6. B. adaxial leaf surface ×1. C. leaf margin detail ×0.6. D. capitulum with flowers and fruits removed, lateral view ×6. E. abaxial capitulum surface with scape removed ×6. F. marginal floret ×16. G. disc floret ×16. H. achene ×16. All from *Bean 32442 & Wang* (BRI). Del. W. Smith.

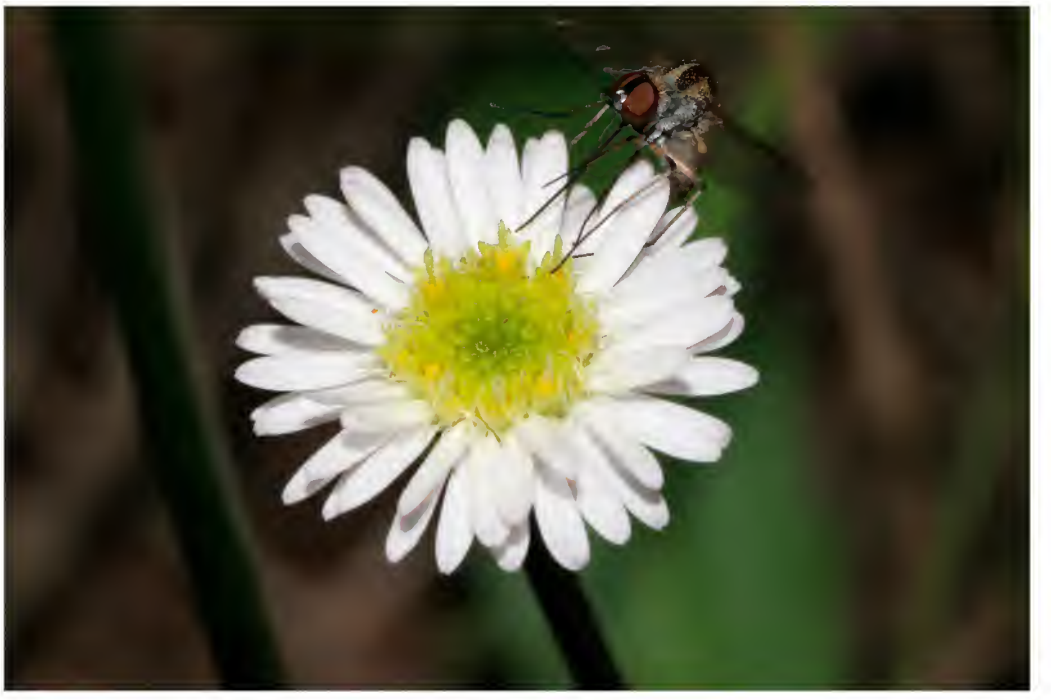

Fig. 6. Flowering head of ***Lagenophora fimbriata*** (*Forster PIF43597 & Leiper*, BRI). Photo: G. Leiper.

(NSW 10281); Burraburri Creek, 16 km W of Durong, May 1992, *Forster PIF9858* (BRI, DNA, MEL); *c.* 10 miles [16.6 km] S of The Gums, Mar 1959, *Johnson 725* (BRI); Calala, *c.* 10 miles [16.6 km] E of Meandarra, Jun 1960, *Johnson 1612* (BRI). Moreton District: 1.4 km along Champion's Way from Cunningham Highway, Willowbank, *c.* 12 km SW of Ipswich, Jan 1993, *Jobson 1872 & Albrecht* (MEL); Champion Way, 1 km N of Cunningham Highway, about 12 km SW of Ipswich, Apr 1991, *Sharpe 5039 & Bird* (BRI); Near Willowbank Raceway, SW of Ipswich, Apr 1990, *Bean 1526* (BRI); Jimboomba, May 1921, *Cheel s.n.* (NSW 10280); Jimboomba, off Kurrajong Road, Mar 2016, *Forster PIF43597 & Leiper* (BRI, MEL, NSW).

***Distribution and habitat*:** *Lagenophora fimbriata* is endemic to south east Queensland, extending from near Cracow to Inglewood, and east to Jimboomba (**Map 3**). It inhabits heavy clay soils in flat or gently undulating terrain, in communities dominated by *Acacia harpophylla* F.Muell. ex Benth. (brigalow) and *Casuarina cristata* Miq. (belah), or *Eucalyptus moluccana* Roxb. (gum top box), or *Melaleuca irbyana* R.T.Baker.

***Phenology*:** Flowers mostly from November to April and fruits mainly from March to May. A mass flowering event also recorded in July 2016 by the authors.

***Notes*:** *Lagenophora fimbriata* is of similar appearance to the parapatric *L. gracilis*, but differs by the glabrous leaf surface, the fimbriate leaf margin, the larger involucre 11–14 mm diameter (usually 6–8 mm long for *L. gracilis*), the larger ligules 3–4.7 × 0.5–1.1 mm (2.1–2.2 × 0.3–0.4 mm for *L. gracilis*), the more numerous (at least twice as many) disc florets 46–62 (10–20 in *L. gracilis*), and the glands on the achene distributed along dorsal edge from beak to near base (the glands confined to dorsal side of beak and adjacent area of achene for *L. gracilis*).

***Conservation status*:** Although *Lagenophora fimbriata* has a restricted distributional range in south east Queensland, it can be locally abundant where it occurs. A species survey

by us found that on a 4-hectare property at Jimboomba (Voucher: *Forster PIF43597 & Leiper*), the population size varied from 120 to 190 plants per 100 square metres, with a total of 5000–6000 plants estimated. To date, there are only eight locations where the species has been recorded (**Map 3**). There is evidence that due to urban development and habitat destruction, the species' occupancy area has declined in the past decade. Therefore, a **Vulnerable** conservation status is recommended based on the IUCN (2012) criteria VU B2(a), (b) (iii).

***Etymology*:** From the Latin *fimbriatus*, meaning 'fringed'. This refers to the fimbriate leaf margins of this species.

5. Lagenophora brachyglossa Jian Wang ter & A.R.Bean **sp. nov.** with affinity to *L. gracilis*, but differing by the very short ligule, the longer achene, the glands over the beak and the glands on base of the achene on both ventral and dorsal edges. **Typus:** Queensland. Moreton District: 3.2 km along Duck Creek Road, near Lamington National Park, 29 February 2016, *A.R. Bean 32729 & J. Wang* (holo: BRI; iso: NSW).

Herb with rhizomes, roots fleshy, bunched, 0.6–1.6 mm diameter; stem absent or to 5 mm long. Leaves 6–9, oblanceolate to obovate, 3–10 cm long, 0.9–2.5 cm wide (3.3–4 times longer than wide), sessile or with a winged petiole to 2 cm long, apex obtuse, margins crenate to sinuate, with 13–21 teeth, each 0.5–1.5 mm long. Upper leaf surface grey-green, with 3–7 eglandular hairs per mm^2, each 0.2–0.3 mm long. Lower leaf surface pale green, with 3–7 eglandular hairs per mm^2, each 0.2–0.3 mm long. Leaf margins with 10–15 eglandular hairs per mm^2, each 0.2–0.3 mm long. Scapes 2–6 per plant, each 10–16 cm long at anthesis, 9–30 cm long at fruiting stage, *c.* 0.6 mm diameter, with 3–5 bracts, each up to 18 × 3 mm. Scape indumentum at midpoint of scape (4–8 hairs per mm), rather more dense towards apex; hairs antrorse, more or less appressed, 0.1–0.3 mm long. Involucre 4–6 mm long, 6–10 mm diameter; involucral bracts 20–40 in 3 or 4 rows, glabrous, outer bracts shorter than the inner bracts, oblanceolate, apex obtuse, margin with short hairs on distal part, outer bracts 1–1.8 × 0.5–0.7 mm, inner bracts 2.2–3 × 0.5–0.7 mm, Receptacle hemispherical, *c.* 2.3 mm diameter and *c.* 0.9 mm long. Ray florets 35–45 in 2–4 rows, female; tube 0.2–0.3 mm long, *c.* 0.2 mm diameter, with minute hairs; stigma 2–branched, each branch 0.2–0.4 mm long; ligule 0.4–0.7 mm long, *c.* 0.2 mm wide, bright pink to purple. Disc florets 15–20, functionally male, corolla light yellow, tube *c.* 1.6 mm long, outer surface with a few minute hairs; lobes 5, deltate, *c.* 0.3 mm long; sterile ovary 0.9–1 mm long. Achenes obliquely oblanceolate, laterally compressed, 3.2–3.7 × 0.7–1.1 mm excluding beak, light brown to brown at maturity, with glands sparsely distributed at the base on both ventral and dorsal edges; hairs absent from base of achene; achene beak 0.6–0.8 mm long, densely glandular throughout, with a white thickened annular collar at its apex, *c.* 0.2 mm diameter. **Figs. 7, 8, 9(5).**

***Additional selected specimens examined*: Queensland.** Maranoa District: Saddler Springs, at spring 5.3 km NNW of homestead, Carnarvon Range, south central Queensland, Jan 2010, *Eddie CPE1791 & Hancock* (BRI). Burnett District: Fig Tree Gully, Bunya Mountains, Jun 2003, *Butler & Fairfax s.n.* (BRI [AQ613294]). Darling Downs District: 7 km WNW of Clifton, Feb 1995, *Fensham 1997* (BRI); 23 km SSE of Toowoomba, Feb 1995, *Fensham 2073* (BRI); Allora Mountain, Allora, Nov 2005, *Flesser s.n.* (BRI [AQ724458]); 16 km NNE of Stanthorpe, Mar 2010, *Thompson EJT252B & Brennan* (BRI). Moreton District: 3.6 km along Duck Creek road, near O'Reillys guest house, Mar 2001, *Bean 17391B* (BRI). **New South Wales.** North West Slopes: Oxley Park, Tamworth, Nov 1985, *Hosking s.n.* (NSW 563235, 563552). Central Western Slopes: Hoffman Property, near Muswellbrook, May 2003, *James & Corkish s.n.* (NSW 721138). Central Coast: Kentlyn Road, Campbelltown, Mar 1962, *McBarron 6947* (NSW); Sportsground, Appin, Feb 1967, *McBarron 13928* (NSW). South Western Slopes: Tarcutta Hills (Bush Heritage's site), Aug 2004, *Burrows s.n.* (NSW 723815). **Victoria**. Devils Backbone, W of Snowy River, East Gippsland, Mar 1971, *Beauglehole 37267* (MEL).

***Distribution and habitat*:** *Lagenophora brachyglossa* is endemic to eastern Australia. It is a relatively widespread species occurring in New South Wales, Queensland and Victoria. In Queensland, it extends from near Stanthorpe and the Lamington Plateau, north-west to the Carnarvon Range. It occurs mainly in the higher altitude and higher rainfall areas (**Map 3**). It usually grows on basaltic clayey

Fig. 7. ***Lagenophora brachyglossa***. A. habit of whole plant with flowering and fruiting inflorescences ×0.6. B. adaxial leaf surface ×1. C. leaf margin detail ×4. D. capitulum with flowers and fruits removed, lateral view ×8. E. abaxial capitulum surface with scape removed ×8. F. marginal floret ×16. G. disc floret ×16. H. achene ×16. A, D, E, H from *Butler & Fairfax s.n.* (BRI [AQ613294]); B & C from *Bean 32729 & Wang* (BRI); F & G from *Bean 17391B* (BRI). Del. W. Smith.

soils in open forests and woodland with grassy understorey dominated by variously *Eucalyptus biturbinata* L.A.S.Johnson & K.D.Hill, *E. caliginosa* Blakely & McKie, *E. crebra* F.Muell., *E. eugenioides* Sieber ex Spreng., *E. laevopinea* R.T.Baker, *E. microcorys* F.Muell., *E. moluccana*, *E. orgadophila* Maiden & Blakely, *E. tereticornis* Sm. and/or *Angophora floribunda* (Sm.) Sweet. It may co-occur with *L. gracilis* at some localities in Queensland.

***Phenology*:** Flowers are recorded from November to March; fruits from January to June.

***Notes*:** *Lagenophora brachyglossa* is of similar appearance to the parapatric *L. gracilis*, but differs by the very small ligule 0.4–0.7 × 0.2 mm (2.1 –2.2 × 0.3–0.4 mm for *L. gracilis*), the longer achene 3.2–3.7 mm long excluding beak (2.4–2.8 mm long excluding beak for *L. gracilis*), the glands throughout the beak and the glands on base of both ventral and dorsal edges (the glands confined to dorsal edge of beak and adjacent area of achene for *L. gracilis*). In addition, *L. brachyglossa* lacks hairs at the base of the achene.

***Conservation status*:** Although *Lagenophora brachyglossa* has been noted as occasional on herbarium specimen labels, it is likely to be widespread and easily overlooked due to its seasonal flower and fruiting habit. It is not considered to be threatened and a **Least Concern** conservation status is recommended using the IUCN (2012) criteria.

***Etymology*:** From the Greek *brachy* and *glossus*, meaning 'short-tongued'. This refers to the very short ligules of this species.

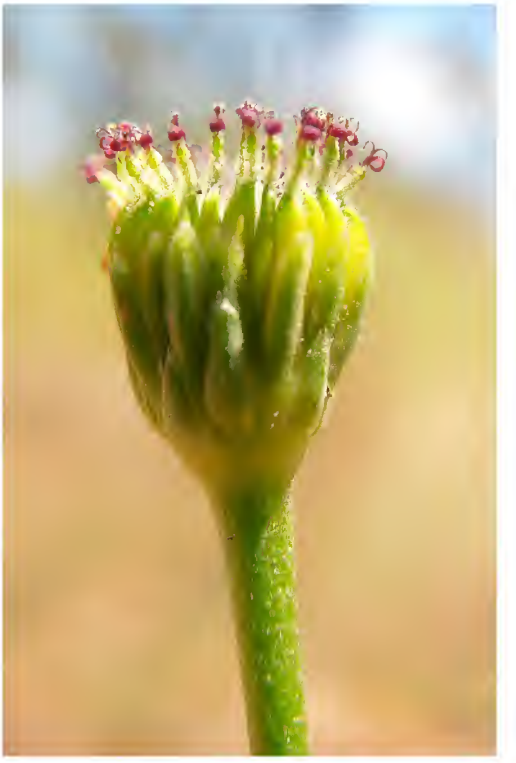

Fig. 8. Flowering head of ***Lagenophora brachyglossa*** (*Bean 32729 & Wang*, BRI). Photo: A.R. Bean.

Acknowledgements

We thank the Directors of MEL and NSW for providing loan specimens, Will Smith for illustrations and distribution maps, Michael Mathieson and Glenn Leiper for photographs of the plants, Greg Keith and staff of Girraween NP for field assistance during our visit to the park, Peter Copping of Logan Shire Council for collecting a specimen of *Lagenophora fimbriata* at our request, and Armin Löckher (W) for searching for the type of *L. gracilis*.

Fig. 9. Achenes of the five Queensland *Lagenophora* species. **1. *Lagenophora stipitata***, upper *Heyligers 80184* (MEL); lower *Bean 32695 & Wang* (BRI). **2. *L. gracilis***, upper *Bean 32713 & Wang* (BRI); lower *Pollock 238* (BRI). **3. *L. queenslandica***, upper *Bean 11955* (BRI); lower *s. coll.* (BRI [AQ583268]). **4. *L. fimbriata,*** upper *Bean 32442 & Wang* (BRI), lower *Johnson 1612* (BRI). **5. *L. brachyglossa***, upper *Bean 32729 & Wang* (BRI), lower *Butler & Fairfax s.n.* (BRI [AQ613294]). Scale bar = 5 mm

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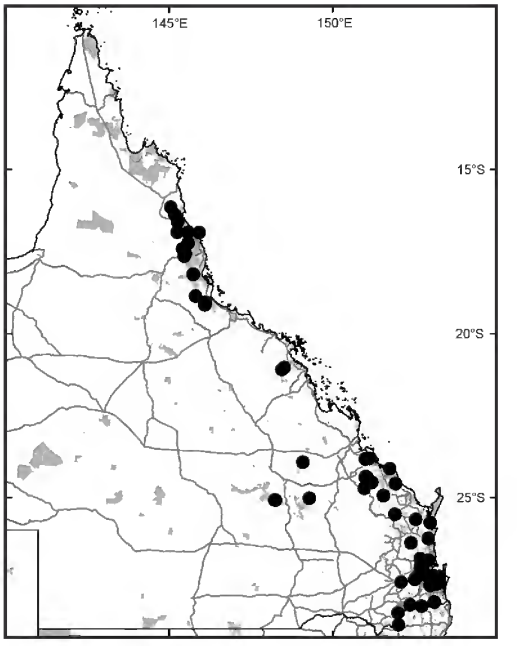
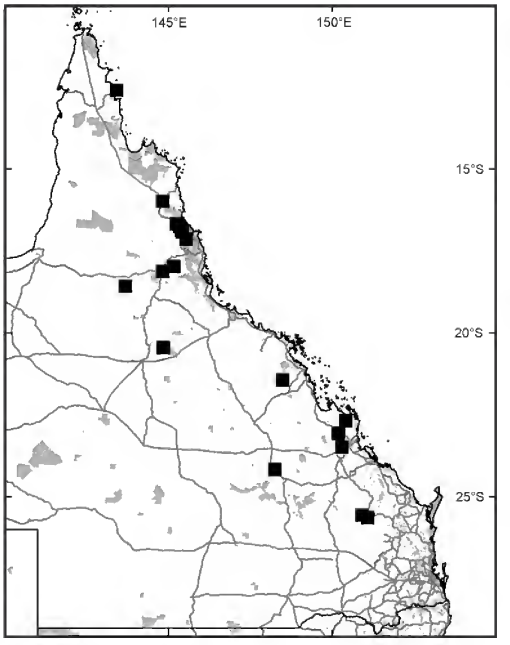
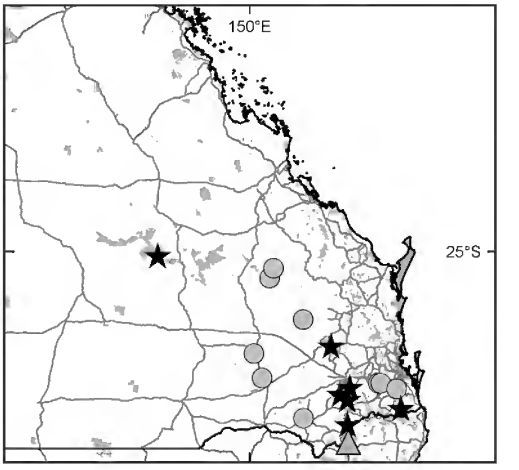


Map 1. Distribution in Queensland of ***Lagenophora gracilis***.



Map 2. Distribution of ***Lagenophora queenslandica***.



Map 3. Distribution of ***Lagenophora stipitata*** ▲ (Queensland records only), ***L. fimbriata*** ● and ***L. brachyglossa*** ★.

Bruguiera hainesii C.G.Rogers (Rhizophoraceae), an endangered species recently discovered in Australia

W.E. Cooper[1], H. Kudo[2] & Norman C. Duke[3]

Summary

Cooper, W.E., Kudo, H. & Duke, N.C. (2016). *Bruguiera hainesii* C.G.Rogers (Rhizophoraceae), an endangered species recently discovered in Australia. ***Austrobaileya* 9(4): 481–488.** The critically endangered *Bruguiera hainesii* C.G.Rogers (Rhizophoraceae) is newly recorded as occurring on the Australian mainland in north Queensland within the city limits of Cairns. The species is described with notes provided on typification, phenology, distribution, habitat, population structure and conservation status. In addition, another *Bruguiera* species, *B. cylindrica* (L.) Blume, known previously in Queensland from south to Cooktown, is reported with a notable range extension south to Cairns. A revised identification key to all taxa of *Bruguiera* in Australia is presented, along with a table of comparative diagnostic characters.

Key Words: Rhizophoraceae, *Bruguiera*, *Bruguiera hainesii*, *Bruguiera cylindrica*, taxonomy, Australia flora, Queensland flora, identification key

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Introduction

The discovery and occurrence of *Bruguiera hainesii* C.G.Rogers in Australia is documented in this paper. *Bruguiera* Lam., from the small pantropic family Rhizophoraceae is distributed from the Indian subcontinent through Malesia to tropical Australia and islands in the western Pacific (Ding Hou 1957, 1958). The family consists of 16 genera and around 120 species of trees and shrubs worldwide. Four genera, comprising *Rhizophora* L., *Ceriops* Arn., *Kandelia* (DC.) Wight & Arn. and *Bruguiera*, are found exclusively in mangroves (Tomlinson 1994; Duke 2013, 2014), and all are conspicuously viviparous.

Bruguiera is distinguished by calyces with 8–16 lanceolate lobes, 16–32 stamens, explosive pollen release, and distinctly viviparous propagules emergent directly from swollen calyces, instead of from a visible fruiting body (Ding Hou 1957, 1958; Sheue *et al.* 2005; Duke 2013, 2014). The genus consists of two groupings of species (**Table 1**), including: four species with large, mostly solitary flowers, namely *B. exaristata* Ding Hou, *B. gymnorhiza* (L.) Savigny ex Lam. & Poiret, *B.* × *rhynchopetala* (W.C.Ko) X.-J.Ge & N.C.Duke and *B. sexangula* (Lour.) Poir., and three species with 2–5 small flowers in each inflorescence, namely *B. cylindrica* (L.) Blume, *B. hainesii* and *B. parviflora* (Roxb.) Griff. (Duke & Ge 2011). Previous records have shown that six species occurred in Australia (Duke 2006); however, this new discovery confirms that all seven species occur in Australia.

Bruguiera hainesii was discovered in Australia as a population of around 49 trees at Trinity Inlet within the city limits of Cairns by the second author in January 2016. Herbarium collections were made soon after (February 2016) by the first author and taxonomic confirmation was made during a field investigation in early March by the third author. The plants were growing in a

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number of patches amongst other commonly occurring mangrove species close by to a busy industrial area.

There were three *Bruguiera* species growing in close proximity to *B. hainesii* in Trinity Inlet, including *B. gymnorhiza*, *B. parviflora* and *B. cylindrica*. The occurrence of *B. cylindrica* is a significant range extension for the species (voucher at BRI: *Cooper et al. WWC2312*) (Kudo 2016) that was previously known for its' southern-most records in the Jeannie River and Endeavour River near Cooktown. A fifth *Bruguiera* species, *Bruguiera exaristata* occurs a few kilometres away, along the Cairns Esplanade. The remaining species in the genus are known to the north of Cairns, in larger riverine estuaries; the most notable being the Daintree River (Duke 2006).

These new discoveries confirm Australia as a region of maximal diversity for *Bruguiera*, having all seven species. The last taxonomic account of the genus in Australia enumerated five species (McClusker 1984), so a revised identification key to all species plus comparative Table of diagnostic features are presented.

Materials and methods

The study is based upon field observations and examination of herbarium material from BRI and CNS. All specimens cited have been seen by the authors. Measurements of the floral parts and fruits are based on fresh material, as well as dry preserved collections.

Taxonomy

Key to *Bruguiera* species in Australia (also see Table 1):

1 Flowers solitary **2**
1. Inflorescence 2–5-flowered, rarely 1 . . . . . **5**

2 Petals without a central spine or spine minute, *c.* 0.2 mm long . . . . . **B. exaristata**
2. Petals with a central spine, > 3 mm long **3**

3 Petals without apical bristles or bristles minute, *c.* 0.3 mm long . . . . . **B. sexangula**
3. Petals with apical bristles, > 1 mm long **4**

4 Petal lobes with 3–4 bristles; bristles > 2 mm long . . . . . **B. gymnorhiza**
4. Petal lobes with 1–2 bristles; bristles < 2 mm long . . . . . **B. × rhynchopetala**

5 Mature flower buds 18–22 mm long, 9–11 calyx lobes . . . . . **B. hainesii**
5. Mature flower buds 10–15 mm long, 8 calyx lobes **6**

6 Calyx lobes stout 2–3 mm long; fruit calyx lobes adpressed against hypocotyl . . . . . **B. parviflora**
6. Calyx lobes elongate 4–6 mm long; fruit calyx lobes reflexed at right angles to the hypocotyl . . . . . **B. cylindrica**

Taxonomy

Bruguiera hainesii C.G.Rogers, *Bull. Misc. Inform. Kew* 1919(5): 225 (1919). **Type:** India (Burma/Myanmar). Mergui, [Panadaung Reserve, 2 January 1919], *C.S. Rogers 456M* (syn: CAL, K *n.v.* [refer to typification section]).

***Illustrations*:** Sheue *et al.* (2005); Duke (2013, 2014).

***Bruguiera hainesii* in Australia: Tree** to 18 m, dbh to 61 cm; evergreen; buttresses well developed, mostly triangular; knee-roots numerous; bark on smaller trees grey with numerous large pustules or lenticels, bark on larger trees dark brown and tessellated. **Stipules** paired, green, curved, 38–42 mm long, glabrous; colleters densely packed, *c.* 0.75 mm long, clustered at base within a triangular or trapezoid pattern about 7.5 × 7.5 mm, *c.* 400 in *c.* 20 rows, viscous. **Leaves**

simple, opposite; petiole 15–33 mm long, channelled adaxially; lamina discolorous, upperside very dark green, underside paler and sometimes sparsely black-dotted, elliptic, oblong-elliptic or elliptic-obovate, coriaceous, 80–140 × 36–61 mm, glabrous, apex acute or very shortly acuminate, base cuneate or attenuate, margin entire and often recurved, venation brochidodromous, intramarginal vein present, primary vein ± flush on upperside and distinctly raised below, secondary veins 9–11 pairs, tertiary venation reticulate. **Inflorescence** axillary, 1–3-flowered (rarely 1), simple dichasium, peduncle 3–8 mm long; bracteoles narrowly triangular or rarely 3-lobed, 0.5–0.8 mm long, silvery, caducous; pedicels 5–7 mm long. **Flowers** bisexual, 22–24 mm long, scentless; **hypanthium** somewhat conical, slightly ribbed, diameter 6–7 mm; sepals free, 8–10, spreading widely at anthesis, yellowish-green, pinkish-green or reddish; **petals** 8–10, free, folded vertically, obovate, 8.5–10 mm long, orange, apex emarginate with a solitary bristle *c.* 4 mm long emerging from the sinus which extends 1–2 mm beyond lobes, lobes each with 3 or 4 apical bristles *c.* 3 mm long, glabrous adaxially or a few minute white hairs near apex, abaxially with long white sericeous hairs near margin; stamens 2 per petal (one usually much longer than the other), 5–8 mm long; anthers linear, 2–2.5 mm long, apex apiculate, bilocular, basifixed or almost so; style slender; stigma 2 or 3-lobed, ovary *c.* 10 mm long, 1 locule with 4 or 6 ovules. **Fruit** seated within hypanthium, sepals ± at right angles and curved at the tips or broadly clawed. **Hypocotyl** emergent from calyx, slightly curved finger-like, slight longitudinal ribbing, green to brownish, up to 120 mm long and 12 mm wide. **Figs. 1–6.**

***Additional specimens examined*: Papua New Guinea:** Port Moresby, Jul/Aug 1918, *White 128* (BRI). **Australia. Queensland.** Cook District: Chinaman Creek, Cairns, Feb 2016, *Cooper 2316, Kudo & Venables* (BRI, CNS); Chinaman Creek, Cairns, Feb 2016, *Cooper 2317, Kudo, Jensen, Jago & Venables* (CNS).

Distribution and habitat: *Bruguiera hainesii* is sparsely distributed through a broad area from South-East Asia (Myanmar) through Malesia (Malaysia, Indonesia, Singapore, Papua New Guinea) to Melanesia (Solomon Islands) and Australia. In Australia, it is known only from a single, small population in Trinity Inlet at Cairns, north Queensland. It occurs in the landward mangrove zone where it is inundated only by very high tides, co-occurring with *Aegiceras corniculatum* (L.) Blanco, *Bruguiera cylindrica*, *B. gymnorhiza* and *Xylocarpus granatum* K.D.Koenig.

Fig. 1. Growth form habit of ***Bruguiera hainesii*** in Trinity Inlet, Cairns. Note the distinctively erect stems, the rough dark bark, and the stout, knobbly buttresses and surrounding knee roots. Photo: H. Kudo.

***Phenology*:** Flowers have been recorded in January, February and March; mature propagules were observed as scarce in February and March.

***Typification*:** The title page of the paper wherein this species was described has as subtext "Plantarum Novarum in Herbario Horti Regii Conservatarum", which is clear indication that the type collection was at K at least at the time of description. Rogers' herbarium and types are at multiple herbaria, including CAL. There appear to be multiple sheets at K of this collection (K 000732744 and K 000732745 as available online via JSTOR), both collected from Mergui, but neither with

Fig. 2. Stem of adult ***Bruguiera hainesii*** showing detail of the bark (*Cooper 2317 et al.*, CNS). Photo: R.L. Jago.

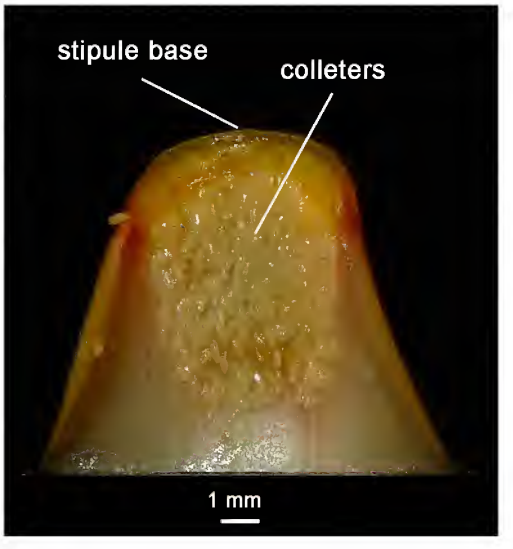

Fig. 3. Distinctive patch of colleters at the inner base of the interpetiolar stipule from a ***Bruguiera hainesii*** apical shoot from the Cairns population. Photo: N.C. Duke.

an indication of collector or date of collection. The online listing of type collections at CAL lists *Rogers 465M* as being extant in that herbarium and the collection may have been distributed elsewhere. Although it is likely that these all represent the Rogers type collection the possibility remains that other material is present at K and elsewhere, so lectotypification of this name is not proposed at this stage (*viz.* McNeill 2014).

***Notes*:** The identification of many mangroves, including species of *Bruguiera* can be difficult where reproductive material is absent. Sheue *et al.* (2005, 2012) suggested using colleters on the stipules to distinguish between similar species of *Bruguiera*. However, we have found that *B. hainesii* is distinct in the field by its growth habit, bark characteristics, flowers and fruit (**Table 1**). Overall, *B. hainesii* is distinguished from other *Bruguiera* by its intermediate sized mature flower buds, on mostly 3-flowered inflorescences, with 8–10 calyx lobes, and bilobed petals with a long spine between lobes and 3 bristles on each tip.

Australian material of *Bruguiera hainesii* differs from those in Singapore (Sheue *et al.* 2005, 2012) in fewer calyx lobes (8 or 9 rarely 10 versus 10 or 11; see **Fig. 4**) and many more colleters (400–500 versus 100–146; see **Fig. 3**).

Genetic evidence indicates that *Bruguiera hainesii* populations from Malaysia and Singapore are a natural hybrid between *B. gymnorhiza* and *B. cylindrica* (Ono *et al.* 2016). If *B. hainesii* is of hybrid origin, then this may explain in part the low numbers of individuals encountered near Cairns when compared to the other co-occurring species. There remain important questions about determinations of hybrid status in *Bruguiera* as the observed stands of *B. hainesii* in Australia have mature viviparous propagules that appear viable (**Fig. 5**). The confirmation of hybrid status for Australian populations of *B. hainesii* requires genetic analysis to determine if this is also the case and whether the same parental species are involved.

Table 1. Diagnostic morphological attributes, including ranges of key measured and multi-state characters, of all *Bruguiera* species in Australia. All measures and observations were taken from fresh material

Component	Attribute*	*B. parviflora*	*B. cylindrica*	*B. hainesii*	*B. exaristata*	*B. gymnorhiza*	*B.* × *rhyn-chopetala*	*B. sexangula*
Leaves	L	70–130	70–170	90–130	50–120	90–240	110–210	100–200
	W	20–40	20–80	40–70	20–50	30–90	40–80	40–70
Mature Flower Buds	Calyx Tube Shape	elongate, slightly ribbed	turbinate, smooth	turbinate, smooth	ribbed	smooth to slightly ribbed	ribbed, sometimes smooth	ribbed, rarely smooth
Inflorescence	Bud N	3–4	3	(1) 2–3	1	1	1	1
	Bud Tip Shape	bluntly acute	bluntly acute	broadly acute	broadly acute	pointed	pointed	pointed
	Bud L	15	10–12	18–22	25–28	30–50	29–40	30–35
	Lobe N	8	8	9–11	8–10	9–15	9–12	12–14
	Lobe L	2–3	4–6	11–12	12–13	15–25	18–21	16–19
	Petal L	1.5–2	3–4	7–9	9–10	13–19	14–17	9–15
	Petal Bristle N	3	2–3	3	0, rarely 1	3–4	1–2	0, rarely 1
	Petal Bristle L	0.3–0.4	0.5–0.6	1.2–1.5	0–0.2	2–3.5	1.2–1.9	0–0.3
	Petal Spine L	0.7–0.8	1–1.2	3–4	0–0.2	5–6	4–5	4–5
	Petal Spine	exceeds lobe	exceeds lobe	exceeds lobe	absent, minute	equal to lobe	equal to lobe	equal to lobe
	Petal Tip Shape	rounded	obtuse	obtuse	obtuse	tending acute	obtuse to acute	obtuse
Mature Fruit	Calyx Lobe Shape	adpressed	fully reflexed	claw-like	claw-like	reflexed slightly	reflexed slightly	reflexed slightly
	Hypocotyl L	90–150	90–150	150–180	90–110	100–250	95–140	50–110
	Hypocotyl W	4–5	5–8	9–11	9–10	15–20	10–20	10–15

*Attribute: N = number; L = length in mm; W = width in mm.

Our observations at Trinity Inlet in April 2016 indicate that there exists a population of *Bruguiera hainesii* with reproducing individuals of different size classes. A preliminary demographic assessment of most, if not all, larger individuals in the population found that of the 49 trees observed, mean stem diameter was 14.3 cm with a range from 2–61 cm (**Fig. 7**). The population structure appeared healthy with abundant younger reproductive individuals and one or two older mast individuals. An indication of the current reproductive potential is shown where the percentage of trees flowering increased from

Fig. 4. Open flower between mature flower buds of a ***Bruguiera hainesii*** inflorescence. Petal lobe bristles and other characters of the flower (note calyx numbers around 9) (*Cooper 2317 et al.*, CNS). Photo: N.C. Duke.

Fig. 5. Face view of open flowers of ***Bruguiera hainesii*** (*Cooper 2317 et al.*, CNS). Photo: R.L. Jago.

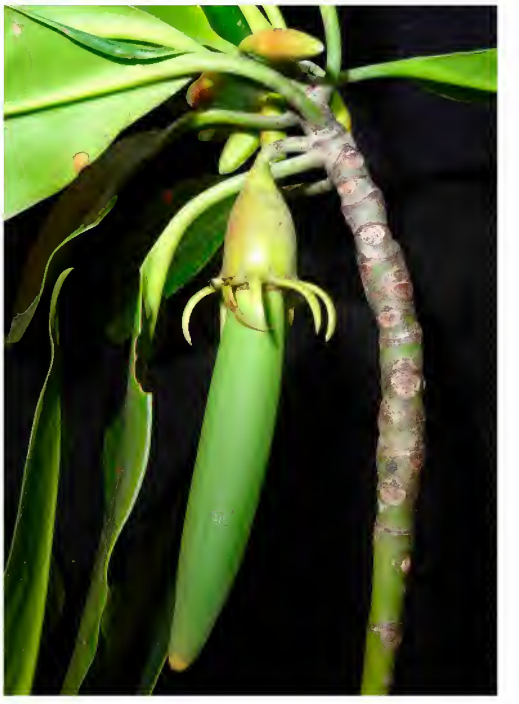

Fig. 6. Viviparous mature propagule of ***Bruguiera hainesii***, note the reflexed, claw-like lobes of the calyx (*Cooper 2317 et al.*, CNS). Photo: N.C. Duke.

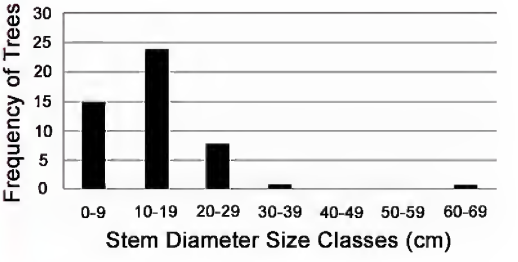

Fig. 7. Population demography of ***Bruguiera hainesii*** in Australia shown for stem diameter size class frequencies. Del: N.C. Duke.

26.7% and 87.5% in the smallest size classes to 100% in all larger size classes (**Fig. 8**). By these preliminary indicators this seemingly isolated population appears viable and sustainable while current circumstances are maintained.

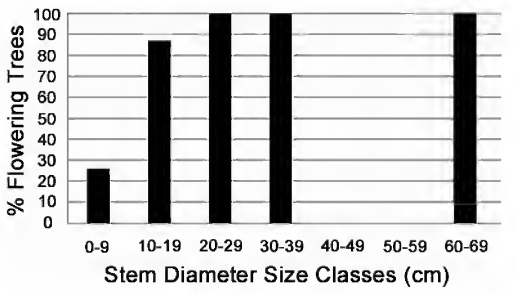

Fig. 8. Age related reproductive condition of ***Bruguiera hainesii*** with stem diameter size class frequencies. Del: N.C. Duke.

***Conservation status*:** *Bruguiera hainesii* is considered by the IUCN to be critically endangered, being known in small numbers from a few seemingly isolated locations in Myanmar, Thailand, Malaysia, Indonesia, Singapore, Papua New Guinea and Solomon Islands. The Solomon Island record refers to an individual tree, only identified in 2011 (Duke *et al.* 2012). Given that the Australian population appears to be viable, more research is needed to determine the reproductive status of the populations in other parts of its distribution range.

It has been estimated that there are less than 250 mature individuals of *Bruguiera hainesii* remaining worldwide (Polidoro *et al.* 2010), although this does not incorporate the Australian population. Given that *B. hainesii* may be a species of hybrid origin (Ono *et al.* 2016) it is possible that some government authorities may view its conservation as being of less significance than the putative parental species. Speciation by hybrid origin is one of the numerous evolutionary pathways whereby many species worldwide have arisen (Hegarty & Hiscock 2004; Mallett 2007), so this origin is not relevant when assessing conservation status, although the IUCN does not assess species considered to be of hybrid origin. The single population and low numbers of individuals in Australia do not greatly augment the world population of this species, so we would support the continued ranking of **Critically Endangered**.

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Walter Hill: his involvement with palms (Arecaceae), and notes on his herbarium and the expeditions of 1862 and 1873

John Leslie Dowe

Summary

Dowe, J.L. (2016). Walter Hill: his involvement with palms (Arecaceae), and notes on his herbarium and the expeditions of 1862 and 1873. ***Austrobaileya* 9(4): 489–507.** Walter Hill was the Director of the Brisbane Botanic Garden and Queensland Colonial Botanist 1855 to 1881. Botanical exploration was in its infancy in Queensland at that time, and Hill was the first botanist to record palm species on Cape York Peninsula and north-east Queensland during expeditions of 1862 and 1873 respectively. He observed or collected 18 species during these expeditions including *Archontophoenix alexandrae* (as *Ptychosperma alexandrae*), *Arenga australasica* (as *Sagus farinifera* and *S. blackallii*), *Calamus aruensis* (as *Zalacca* sp.), *Calamus australis*, *Caryota albertii* (as *Caryota urens*), *Cocos nucifera* (as cocoanut), *Hydriastele costata* (as *Pinanga* sp.), *H. wendlandiana* (as *Areca* sp.), *Laccospadix australasicus* (as *Kenti*), *Licuala ramsayi* (as *Livistona* sp.), *Linospadix minor* (as *Areca minor*), *L. palmerianus* (as *Areca* sp.), *Livistona decora*, *L. drudei*, *L. muelleri* (all as *L. inermis*), *Normanbya normanbyi* (as *Cocos normanbyi*), *Oraniopsis appendiculata* (as a 'beautiful palm') and *Ptychosperma elegans* (as *Seaforthia elegans*). Hill was nomenclaturally associated with seven palm taxa, only two of which, *Areca minor* W.Hill (*Linospadix minor*) and *Cocos normanbyi* W.Hill (*Normanbya normanbyi*), are accepted as valid taxa and the others are invalid names of no taxonomic standing, and include *Areca northiana* W.Hill ex Hemsl., *Pinanga smithii* W.Hill, *Ptychosperma hillii* W.Hill, *Ptychosperma kennedyana* W.Hill and *Sagus blackallii* W.Hill. Notes are also provided on Hill's herbarium and the itineraries of the expeditions of 1862 and 1873 are outlined.

Key Words: Arecaceae, Palmae, palms, Queensland flora, Brisbane Botanic Garden, Cape York Expedition 1862, Colonial Botanist, Ferdinand Mueller, North-East Coast Expedition 1873, Walter Hill

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Introduction

Walter Hill (b.1820–d.1904) (**Fig. 1**) was the first Superintendent and later Director of the Brisbane Botanic Garden 1855–1881, and Queensland Colonial Botanist 1859–1881. His expertise was in horticulture having been trained and employed in the Edinburgh Botanical Garden, 1841–1843, and Kew Gardens, 1843–1851, before migrating to Australia in 1852 (Hill 1844; Queenslander 1904; Maiden 1910). Upon his appointment as Superintendent of the Brisbane Botanic Garden in 1855, Hill's primary interest was in the introduction of potentially economically important plants through experimental and acclimatisation projects (Hill 1873, 1880a; Bailey 1904; Everist 1982; Clements 1999; McKinnon 2009). The Brisbane Botanic Garden is now known as City Botanic Gardens, Brisbane and herein abbreviated as BBG. Although his interest was in useful and economic plants, the development of BBG as a horticultural exemplar was also amongst his ambitions. Despite not being a taxonomist by training or inclination, Hill nevertheless made some attempts at systematics, but his few publications were mainly disparaged by other botanists and much of his novel nomenclature was not taken up in the taxonomic literature.

This paper examines Hill's involvement with palms (Arecaceae). The two major expeditions, in 1862 and 1873, in which he observed and/or collected palm specimens are examined as background to his contribution to palm taxonomy, both as a collector and as a taxonomist. Source information was obtained from Hill's Annual Reports of the Brisbane Botanic Garden and other official accounts. Specimen data were mainly obtained online from APNI (2016), AVH (2016), the Kew

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Herbarium Catalogue (2016), and other sources as indicated. Correspondence items were obtained through the Mueller Correspondence Project, Royal Botanic Gardens Melbourne and Global Plants (2016). Plant taxonomy follows the APC (2016). The species names that were used by Hill are maintained at first reference but with corrected spelling, and current names are included, in square brackets, where appropriate. Quotes from letters and publications are verbatim, with retained original spelling, and author comments within quotes are included in square brackets.

Fig. 1. Portrait of Walter Hill. Photographer and date not known. With permission of the Queensland Herbarium.

Excursions, Collections and Taxonomy

Although Hill was a consistent and methodical botanical collector, the extant specimens that can be attributed to him are relatively few in number considering the duration of his career. Based on herbarium databases and literature citations, about 780 specimens have been located. The herbaria that hold Hill specimens include MEL (*c.* 525) and K (*c.* 85), and with small numbers in BM, BRI, CNS, GH, HO, LE, NSW, NY and PERTH (AVH 2016; Global Plants 2016; Kew Herbarium Catalogue 2016). Following examination of the major publications relevant to Hill's time, i.e. *Flora Australiensis* (Bentham 1863–1878) and *Fragmenta Phytographiae Australiae* (Mueller 1858–1882), at least 140 citations were found for which specimens have not been located. It is probable that many specimens collected by Hill were either lost or destroyed through various causes, and in particular the result of the unsuitable, and ultimately destructive conditions in which his own herbarium was kept in the Director's residence in BBG (Hill 1873, 1875a, 1876). As an example of specimen loss, Hill (1862a) reported that he had collected at least 50 plant specimens when he visited Port Denison (Bowen) whilst returning from the Cape York Expedition in 1862, but only a few specimens from that location have been located. On the subject of specimen collecting, Hill (1864) wrote that because of his increasing duties in the BBG and as Selector of Agricultural Reserves, that his duties had:

> precluded me from devoting so much time as I wished to collecting contributions to the work on the Australian Flora, by Mr. George Bentham, President of the Linnaean Society. My visit, however, to the northern shores last year, in H.M. ship "Pioneer", enabled me to collect some new specimens of the flora, which were forwarded to Sir W. Hooker, Kew. It will not be out of place to mention, that during this visit I met with *Santalum album* [*Santalum lanceolatum* R.Br.], the tree which furnishes the sandal-wood of commerce, - in the first place on the banks of the Endeavour River [extant at K], and subsequently at Port Denison [not located].

By his own account, Hill collected significant numbers of specimens during the ascent/descent of the Bellenden Ker Range in 1873, but only about 30 have survived. Hill reported that the expedition experienced persistently wet weather during the event and it is probable that many specimens would have perished through damp and mould even before returning to Brisbane. Not unexpectedly, Hill's known palm collections are limited and amount to fewer than 25 specimens comprising about nine taxa (**Table 1**), although his reports and other documentation suggests that he had the opportunity to collect many palm specimens during his travels.

It is unclear if Hill's appointment as Colonial Botanist required that he undertake taxonomic assessment of the Queensland flora, or if he was expected to describe new species. Among his first taxonomic tasks was to identify the specimens collected by Eugene Fitzalan during the Burdekin Expedition of 1860 (Dowe 2015), but Hill (1860a) was only able to identify the specimens, at best, to the family level, thus demonstrating his lack of expertise in such an undertaking. His primary interest lay undoubtedly in the introduction of economically important plants and the assessment of potential agricultural lands, but he was nevertheless expected to make herbarium specimens during his expeditions and other travels (Dalrymple 1874).

Walter Hill's Herbarium

The basis of all plant taxonomy is a functional and enduring herbarium. The earliest documentation relating to the herbarium that Hill maintained in BBG dates from 1857, when Mueller (1858), in a lecture given before the Royal Philosophical Society of Victoria, 5 August 1857, noted that the exhibited specimens were 'selected from a Herbarium formed by Mr. Hill, the Superintendent of the Brisbane Botanic Gardens.' Mueller went on to describe Hill as 'a gentleman of keen observation, and great ardour for botanical research.' Hill's herbarium was housed in the Director's residence (also known as the cottage) in the BBG. The building commenced construction in August 1859 and was completed in 1861 (Queensland Government 1859, 1861). Hill (1862b) wrote that he had 'succeeded in forming the nucleus of a Public Botanical Library and Museum', with the museum to notionally include an operational herbarium, and which were subsequently opened to the public in 1864 (Hill 1864). It became apparent that the Director's residence was not suitable for such a purpose because of 'dampness' and insects. Alterations to the flooring of the building in 1873 were not altogether successful in 'keeping that portion of the building as dry as it ought to be'. Hill (1873) wrote that he had:

> lost two valuable collections of indigenous plants deposited there, and another I brought with me when I left Kew, and which was considered a valuable collection in the mother country. I have still a fair variety of specimens of indigenous plants, including grasses, but it requires arrangement, which can be done when the room is put in a fit state … it is impossible for me to do justice to the Botanical Museum and Library in the way in which the duties ought to be fulfilled. In every other establishment of the kind in Australia, the Director of the Botanic Gardens has one or more skilled assistants to help him in the clerical and general work; – unfortnately I have had little of any such aid.

Hill (1875a) later reported on what was the state of the library and herbarium, writing that the building was:

> unfit in its present condition for books, or for dried specimens where with to form a herbarium, few additions have been made to it in either department [during 1874]. I had occasion first to refer to its dilapidated condition in my annual report for the month of March 1871…Shortly afterwards the room was re-floored and the backs of the book cases lined with boarding, in order to check the action of the damp. This partially succeeded for a time, but ere long the evil complained of became worse than ever… It grieves me much to have again to state that the binding, and in many cases even portions of the works have been completely destroyed by the white ant and other insects…from the same causes I have had almost the whole of my valuable collection of dried specimens, the labour of twenty years in this colony, and also a highly valuable collection, brought with me from Kew, nearly completely destroyed.

Table 1. Palm specimens collected by Walter Hill, providing location, year (if known) and herbarium record data

Taxa [current name]	Specimen details and notes
Archontophoenix alexandrae	Cape York, 1878, *W.Hill s.n.*: MEL 2148270
Archontophoenix alexandrae	Cape York, undated, *W.Hill s.n.*: MEL 2148412–2148413
Areca alicae [*Areca triandra*]	Ex cult., Brisbane Botanic Garden, undated, *W.Hill s.n.*: holo: MEL 1010446–1010450. ***Notes*:** The specimen on which Mueller (1879) described *Areca alicae* was most probably from a cultivated plant at Brisbane Botanic Garden, that had been incorrectly labelled as having been collected by Hill at 'c. 10 miles N of Trinity Bay', but undated. Hill visited Trinity Bay in 1873 and 1876. However, *Areca triandra* was listed as cultivated in BBG in 1875 (Hill 1875b) and flowered for the first time in 1879 (Hill 1879). It is most possible that the specimen was incorrectly labelled in the Brisbane Botanic Garden, as the chance of it being collected in Trinity Bay, from what could only have been a cultivated plant, is highly unlikely. Mueller (1879), in the protologue and in correspondence to Odoardo Beccari, associated it with *Areca triandra* but otherwise described it as *A. alicae*. [Mueller to Beccari, 1879, 5 April, University of Florence, Science Library: Botany, Archives, Beccari 12/32), 'Herewith, dear Dr Beccari, I send you the fruits of a new *Areca* from Trinity Bay. The species is allied to *A. triandra & A. oxycarpa*. I have sent the description to Dr von Regels Garten-Flora'.]
Arecaceae	Moreton Bay, undated, *W.Hill s.n.*: MEL 2217991
Areca minor [*Linospadix minor*]	Bellenden Ker Range, ranges near Mourilyan Harbour, Moresby River, Russell River, 1873, *W.Hill s.n.*: holo: MEL 0079767–0079769
Linospadix monostachyos	Queensland, 1862, *W.Hill 130*: K 000209500
Linospadix monostachyos	Mount Lindsay, undated, *W.Hill s.n.*: MEL 2195651
Linospadix monostachyos	Moreton Bay, undated, *W.Hill s.n.*: MEL 2072876
Linospadix monostachyos	Moreton Bay, undated, *W.Hill s.n.*: K 000209490
Livistona drudei	Port Denison, undated, *W.Hill 41*: K 000209793
Livistona sp. (labelled as *L. lorophylla*)	Queensland, 1862, *W.Hill 21*: K 000209064
Cocos normanbyi [*Normanbya normanbyi*]	Daintree River, [1873], *W.Hill s.n.*: holo: K 000321303. This specimen appears to be a mixture of collections. The leaf is attributed to Hill, and fruit and flowers to other collectors. The leaf was chosen as the holotype by Dowe (2010). Therefore the specimen includes the holotype to which other elements have been added.

Normanbya normanbyi	Daintree River, undated, *W.Hill s.n.*: MEL 2148941
Veitchia arecina [here identified as *Normanbya normanbyi*]	Ex cult., Brisbane Botanic Gardens, May 1881, *W.Hill s.n.*: K 000736216. ***Notes*:** Two original labels accompany this specimen: (1) *Cocos normanbyana*, Brisbane Hort?, W.Hill 1881 (on the packet containing flowers). (2) (*illegible* under shades in Museum), *Areca northeiana*, (cf. *Kentia exorrhiza*), Cardwell, W.Hill May 1881 (letter). According to the specimen slips, Beccari identified it as *Veitchia* sp in 1911; H.E. Moore Jr proposed that it was the holotype of *Veitchia hookeriana* Becc. in 1957; and Zona & Fuller identified it as *Veitchia arecina* Becc. in 1999. Examination of the specimen by this author suggests the correct identity is *Normanbya normanbyi*.
Ptychosperma sp.	Cape York, undated, *W.Hill s.n.*: MEL 2195043
Ptychosperma elegans	Ex cult. Brisbane Botanic Garden, 1875, *W.Hill s.n.*: MEL 2148953. ***Notes*:** The original seeds or plants were possibly collected at Cape York by Walter Hill in 1862. A letter to Mueller, 22 June 1875, accompanied this specimen in which Hill wrote 'the palm found by me at Cape York … The habit resembles the Seaforthia elegans [*Ptychosperma elegans*], and grows about the same height … I found it growing about 50 yards from the *Caryota urens* [*Caryota albertii*] at Cape York.'

Through the demise of Hill's herbarium, and with a general absence of taxonomic actions on his behalf, it can be interpreted that managing a herbarium and active taxonomy were seen by those who appointed him as peripheral to his principal work of plant introduction, agricultural development and forest conservancy. He exhibited no explicit interest, or capability, in developing the BBG as a centre for taxonomic research *per se*, and left such activities to others, for example Ferdinand Mueller, Government Botanist of Victoria, to whom Hill sent a regular supply of specimens, and to F.M. Bailey, Keeper of the Herbarium at the Queensland Museum. Hill supported the establishment of a 'complete collection' in Brisbane when responding to a request from the Acclimatisation Society as to what would be the most useful furniture for the Museum herbarium (Legislative Assembly 1875). The Museum herbarium was established in 1874 (Bailey 1879). Lewis Bernays (Bernays 1873) of the Queensland Acclimatisation Society, wrote in a letter to the Secretary of Public works, that:

> I desire to be permitted to draw your attention to the fact that the colony of Queensland possesses no herbarium of her flora, and in this respect stands almost, if not quite, alone among the Australian colonies.

Bailey (1873) also articulated the need for a public herbarium where specimens could be 'compared and identified'. The Museum herbarium proposal was approved by the Secretary of Lands in May 1874, with £100 being provided. A letter to Bernays included the proviso for the establishment of the herbarium if 'sufficient accommodation can be found in the present Museum building for the purpose…and also to provide suitable furniture for their preservation and exhibition' (Queenslander 1874). In

1875, management of the herbarium was passed from the Acclimatisation Society to the Museum (Queenslander 1876), and by 1877, F.M. Bailey was acting as Keeper of the Herbarium (Everist 1982; Mather 1987; George 2009). Hill (1874a) supported the formation of a herbarium at the Museum, in response to the problems associated with his own herbarium at BBG. In a letter from Charles Coxen (1874) to Secretary of Lands, 5 May 1874, he paraphrased that it was Hill's opinion that:

> there is not sufficient accommodation for the purpose [of a herbarium] at the Botanic Gardens, and that his various duties occupy his time too much to admit of his devoting sufficient leisure to this new object.

The establishment of the Museum Herbarium can be seen as contributing to the cessation of the herbarium at the BBG.

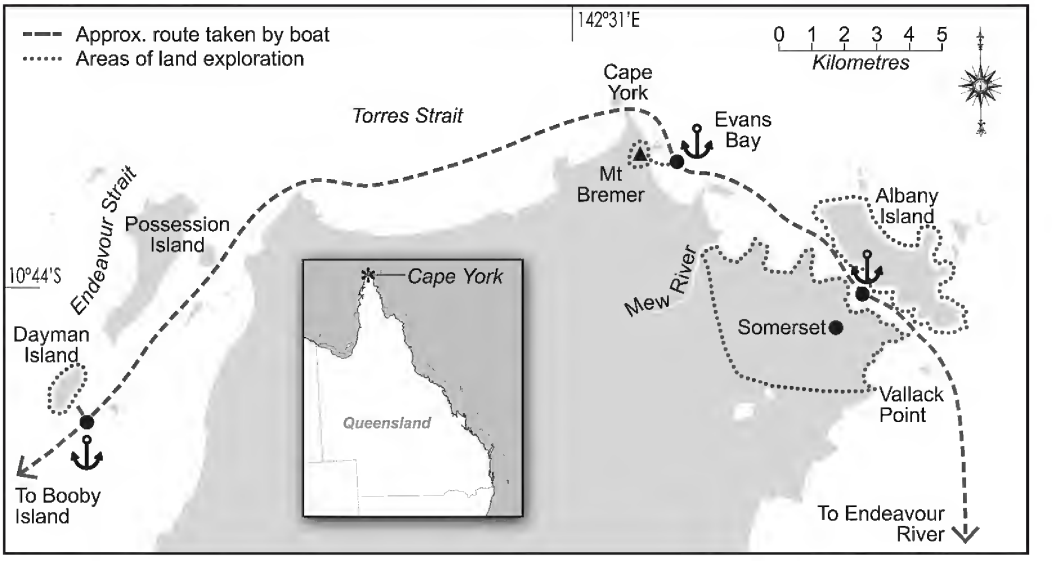
There are only about nine of Hill's specimens presently in BRI. It appears that no specimens were transferred to the new herbarium at the time of Hill's retirement in 1881, but that these specimens had been redistributed to BRI from MEL in the early 20th century. However, it is known that the books from the 'extensive botanical library, previously kept in the Curator's cottage at the Botanic Gardens' were transferred to the Museum in 1881 (Board of Trustees 1882). At the time of Hill's retirement in 1881 (Legislative Assembly 1881; McKinnon 2009), the role of Queensland Colonial Botanist was taken on by F.M. Bailey based at the Museum, and the responsibility of horticultural activities associated with the BBG was given to the head gardener James Pink. It is from the Museum Herbarium that the present-day collection in the Queensland Herbarium was to develop (Holland 2005; Henderson *et al.* 2006).

Cape York Expedition, August/October 1862

Apart from being Director of the Brisbane Botanic Garden and Queensland Colonial Botanist, Hill also held the positions of Selector of Agricultural Reserves and Officer-in-Charge of Forest Nursery Reserves. This allowed him to travel very widely in Queensland. However, there are only two expeditions, the Cape York Expedition of 1862 and the North-East Coast Expedition of 1873, which are of interest with regard to his observations, collection and taxonomy of palms, and it is these expeditions that will be investigated here. There are no noteworthy contemporary accounts of Hill's involvement in the Cape York Expedition, but detailed descriptive accounts of the North-Coast Expedition include those by Jones (1976), Sanderson (2005) and Lavarack (2015). In the following, a general assessment of Hill's botanical pursuits is provided but with an emphasis on his palm related activities.

The Cape York Expedition of 1862, sponsored by the Queensland Government, was intended to facilitate the establishment of a settlement on the northernmost point of Australia, and which was to function as an administrative centre for northern Queensland (Bowen 1864). The expedition was under the direction of Commodore George Burnett, accompanied by Governor George Bowen and with Captain F.C.B. Robinson as the commander of the *HMS Pioneer*, the ship used for the expedition. Hill's primary role was to assess the agricultural and pastoral capabilities of locations visited (Bowen 1864). The expedition departed Brisbane (27 Aug. 1862) and camped at a number of locations whilst *en route* to Booby Island, in western Torres Strait, which they reached in 13 days (9 Sept.). Fast travel times were expedited by favourable south-east winds under sail as there was only enough fuel to drive the steam engines for the return voyage. The expedition spent 14 days in the Cape York area (9–22 Sept.), including Dayman Island (10–11 Sept.), Evans Bay (12–15 Sept.), Albany Island and the adjacent mainland around Somerset (15–22 Sept.) (**Map 1**). The details reported here are based on two reports provided by Hill (1862a, 1862b) and a published account by Bowen (1864).

Hill's first mention of palms was at Fitzroy Island (3 Sept.), where he noted that the 'valleys are filled with dense scrub, occupied by *Calamus australis* (lawyers), *Seaforthia*



Map 1. Exploration route taken during the Cape York Expedition, 1862. Prepared by Claire Burton, Cairns Regional Council.

elegans [*Ptychosperma elegans* (R.Br.) Blume]' and that 'the trees in the forest ground consist principally of the genus *Eucalyptus*, acacias, *Erythrina*, with *Livistonia inermis* [*Livistona muelleri* F.M.Bailey] gracing now and then its ridges.' At this time, Hill appears to have identified all *Calamus* species as *C. australis* Mart., although a number of species occur on Fitzroy Island. Similarly, *Livistona* species other than *L. australis* (R.Br.) Mart., such as *L. decora* (W.Bull) Dowe, *L. drudei* F.Muell. ex Drude and *L. muelleri* were commonly, though incorrectly identified as *L. inermis* R.Br., a distinct taxon originally described from islands in the Gulf of Carpentaria, and an example of the imprecision of the identity of Australian palms at that time. The delimiting of species and genera of Australian palms only started to be resolved with subsequent works by Mueller (1865a, 1870, 1878) who described new species and genera, and Wendland & Drude (1875) who provided the first monograph of Australasian palms with many new species and reassessments of generic limits.

Hill examined Dayman Island (11 Sept.) but did not report any palms from there. The travellers sailed on to Evans Bay (12–15 Sept.) where Hill ventured as far inland as Bremer Peak [Mount Bremer]. Near the coast, Hill noted that the forest was 'occupied with some noble plants of *Caryota urens* [*Caryota albertii* F.Muell. ex H.Wendl. & Drude] [and] *Seaforthia elegans* [*Ptychosperma elegans*]'. In what was possibly the first record of *Arenga australasica* (H.Wendl. & Drude) S.T.Blake & H.E.Moore for Australia, Hill noted that:

> one of the most interesting plants gathered in the neighbourhood of Evans' Bay was a palm not hitherto mentioned as Australian. It is the *Sagus farinifera* (one of the sago producing palms) found in the East Indies; a single plant was first seen in the scrub, near the top of Bremer Peak, and afterwards a clump of it was found in one of the small scrubs close to the Bay.

Hill's identification is problematical, as *Sagus farinifera* Gaertn. [*Raphia farinifera* (Gaertn) Hyl.] is an African species used for starch (from the pith) and fibre (from the leaves), and my interpretation of Hill's description as a 'clump', i.e. clustering palm, and location 'near the top of Bremer Peak' suggest he was observing *Arenga australasica*, and through want of a correct identification named it as *Sagus farinifera*.

The expedition then moved to Port Albany (15–22 Sept.) after which ensued a thorough examination of Albany Island and the adjacent mainland as far inland as Somerset, and along the coast as far west as Mew River and as far east as Vallack Point. Hill described the forest immediately inland from the coast as having a great variety of plants:

> among which are five species of palms, viz, – *Caryota urens* [*Caryota albertii*], *Seaforthia elegans* [*Ptychosperma elegans*], *Areca* sp. [possibly *Hydriastele wendlandiana* (F.Muell.) H.Wendl. & Drude], *Zalacca* sp. [possibly *Calamus aruensis* Becc.], and a species of *Pinanga* [*Hydriastele costata* F.M.Bailey]. The latter rises to a height of 110 feet.

Again, Hill's difficulties with the identities of palms were exacerbated by the lack of knowledge of Australian palms at that time. Palm species, in general, were then grouped into a few very broadly characterised genera, and it is into those that Hill placed his taxa. The palms that he observed in this area included an *Areca* sp, which I interpret as *Hydriastele wendlandiana*; *Zalacca* sp. as juveniles of *Calamus aruensis*; and *Pinanga* sp. which was described by Hill as rising to 110 feet (33 m) in height, as *Hydriastele costata* as it is the only palm in that area to attain such stature. On this basis, Hill was the first to record these species in Australia, albeit by the best available identities available to him. Hill did not record if he made collections of any palms during the Cape York Expedition. However, there are specimens of *Archontophoenix alexandrae* (F.Muell.) H.Wendl. & Drude and *Ptychosperma elegans* in MEL (see **Table 1**), which are suspected (by me) to have been taken from cultivated plants at BBG, most likely grown from seedlings or seeds originally collected by Hill from Cape York during the 1862 expedition. The specimens of *Archontophoenix alexandrae* are uncharacteristically neat and well-prepared thus suggesting that the specimens were carefully prepared from cultivated specimens, whilst the specimen of *Ptychosperma elegans* was accompanied by a letter from Hill to Mueller, 22 June 1875, in which he wrote that 'the palm found by me at Cape York … The habit resembles the *Seaforthia elegans* [*Ptychosperma elegans*], and grows about the same height … I found it growing about 50 yards from the *Caryota urens* [*Caryota albertii*] at Cape York.' This specimen is also uncharacteristically neat and well-prepared. In his treatment of Arecaceae in *Flora Australiensis*, Bentham (1878) cited specimens of *Kentia wendlandiana* F.Muell. [*Hydriastele wendlandiana*] collected by Hill from Cape York, but no specimens have been located at either K or MEL.

The expedition departed Port Albany (22 Sept.), and during the return voyage made stops at Endeavour River (26–27 Sept.), Dunk Island (28–29 Sept.), Tully River and Hull River (29–30 Sept.), Hinchinbrook Channel (30 Sept.), Bowen (1–6 Oct.), Keppel Bay (8 Oct.), Fitzroy River (10–18 Oct.), Port Curtis (18–21 Oct,), Maryborough (22–23 Oct.) before completing the expedition in Brisbane (23 Oct.). Although Hill provided agricultural capability descriptions for most of these locations, there were no further observations of palms after leaving Port Albany.

Results of the Cape York Expedition

It appears that Hill sent many of the specimens collected during this expedition to the Hookers at Kew (Hill 1863; Jackson 1901), and a smaller number to Mueller in Melbourne (Mueller 1865b). There was very little novel taxonomy involving Hill's specimens from this expedition. However, there were a number of important discoveries such as *Rhodomyrtus macrocarpa* Benth. from Albany Island, and the cycads *Catakidozamia hopei* W.Hill [*Lepidozamia hopei* (W.Hill) Regel] collected from the Tully River area and described in the *Gardener's Chronicle* (Hill 1865), and *Bowenia spectabilis* Hook. ex Hook.f. described by Hooker (1863) who noted that it was collected by Hill:

> the zealous and able head of the Brisbane Botanic Garden, [who] rediscovered it in Rockingham Bay, and sent a young living plant, with full-grown dried leaves and a male cone, to the Royal Gardens, Kew, in 1863.

Although Hill observed and recorded a number of palm species at Cape York, there are only a few specimens that are extant. He

also appears to have obtained seeds or live plants, including palms, which he brought to Brisbane to cultivate in BBG, and it is from these that later specimens were sometimes collected (see **Table 1**).

Queensland North-East Coast Expedition, September/December 1873

According to Dalrymple (1874), the North-East Coast Expedition was undertaken on behalf of the Queensland Government, with the intention to:

> explore all rivers, inlets, etc., between Cardwell and the Endeavour River; to ascertain how far the said rivers are navigable for small craft; to ascertain the nature of the soil on or near the banks for agricultural purpose; and to assist the curator in collecting botanical specimens.

The party consisted of 26 personnel with George Elphinstone Dalrymple, Officer in Charge; Sub-Inspector F.M. Tompson, Second in Command; Sub-Inspector Robert Johnstone, Officer in Charge of Native Mounted Police; Walter Hill, botanist; and the remainder consisting of ships' masters, seamen, boatmen and Native Police Troopers. The vessels initially used were the cutters *Flying Fish* and *Coquette*, and later, after they became inoperable, the schooner *Flirt* was commissioned. A towed whaleboat was used to enter small channels and streams. The following travel and collecting scenarios are compiled from four sources, Dalrymple (1874), Hill (1874b, 1874c) and Johnstone (1874).

The expeditioners assembled at Cardwell in the few weeks before departure (29 Sept. 1873) and made their first camp on Dunk Island (29–30 Sept.). As the cutters were unsuitable for on-board accommodation, the intention was to go ashore each night to make camp. At Dunk Island, Hill reported that 'the vegetation is composed of the genera *Hellenia* [*Alpinia*], *Musa*, *Calamus*, *Brassaia* [*Schefflera*], *Myristica*, *Wormia* [*Dillenia*], *Alstonia*, *Eucalyptus*, *Acacia*, &c., &c.'

They departed Dunk Island, passing North Barnard No. 3 (30 Sept–1 Oct.), and Mourilyan Harbour and Moresby River (1–4 Oct.). At Moresby River, Hill wrote that 'the natural vegetation is composed of *Calamus, Livistona, Cardwellia,* &c., &c.'. *Livistona* can here be interpreted as *Licuala ramsayi* (F.Muell.) Domin. Dalrymple wrote that during their stay at Mourilyan Harbor 'Mr. Hill protected by the native police, made a large collection of botanical treasures'. At this location, the party was accompanied by Philip Henry Nind, a planter looking for new sugar cropping areas. At the navigational limit of the Moresby River, Dalrymple noted that 'Mr. Nind discovered a very beautiful new tree orchid with a stem some seven feet long'. This orchid was described by Hill (1874b) as *Dendrobium nindii* W.Hill. The Johnstone River (named by Dalrymple) was entered and explored (4–14 Oct.). Upstream of Coquette Point, Hill wrote:

> from Nind's Creek up to the head of boat navigation...the genera are chiefly *Musa*, *Colocasia*, *Costus*, *Hellenia* [*Alpinia*], *Arundo*, *Bambusa* [*Mullerochloa*], *Calamus*, *Ficus*, &c., &c., which are very abundant.

During this part of the exploration, Dalrymple named the Walter Hill Ranges, noting that 'Mr. Walter Hill, by exploration of the rich alluvial lands north and south of this range, has honourably connected his name to it'. In this area, Dalrymple (1874) named Bamboo Creek and Banana Island because of the prevalence of those plants at those places. Hill (1874b) named *Musa jackeyi* W.Hill and *M. charlioi* W.Hill from this area, the former a distinctive banana with short erect fruit (4–7 cm long × 2–4 cm wide), and the latter described with a dinghy-green rather than black stem and with a nodding rather than erect inflorescence. They departed Johnstone River (14 Oct.), and the expedition sailed north to Frankland Islands (14–15 Oct.). On the south-east end of Frankland Island No. 1 [Russell Island], Dalrymple (1874) noted that there were:

> about two dozen fine cocoanuts [*Cocos nucifera* L.], the only grove of these useful and graceful trees along the whole coast, nestled under the steepest part of the wooded hill, they are in full bearing and vigorous growth, and give quite an oriental character to the island.

As coconuts were a desirable addition to their diets, Dalrymple:

> sent the Native Police Troopers up the trees, and obtained a supply of ripe and drinking coconuts, the latter containing about a pint of water, which resembles delicately fruit-flavored *con sucré*, and is a delicious and cool drink in the early morning.

Hill (1874c) also wrote about this population noting that:

> on the extreme end of the island we found two clumps of cocoanut-trees, extending for about fifty yards inland, but within reach of the sea spray. They were twenty-eight in number; thirteen of them were bearing, and the others will bear in the course of two or three years. Three or four of them were about fifty feet in height. The trunks, in some cases, were much cut; and two trees had been felled, no doubt for the purpose of obtaining the nuts.

Up to that time, this population of coconuts was the only one recorded on the entire east coast of Queensland. It has been interpreted as possible evidence of a pre-European (i.e., pre-1770) presence of the species in Australia (Dowe & Smith 2002).

Trinity Inlet was explored (15–18 Oct.), with camps set up on Double Island (18–23 Oct.), Snapper Island (23–24 Oct.), Endeavour River (24–29 Oct.), to as far north as Three Isles (29–31 Oct.), then returning south to North Frankland Island [Normanby Island] (31 Oct.–1 Nov.) and South Barnard Island (2–7 Nov.). The expedition returned to Cardwell (7–18 Nov.) where the personnel were reorganised, and the schooner *Flirt* was commissioned to complete the Expedition. The cutters *Flying Fish* and *Coquette* were decommissioned because of their unseaworthiness. During this period (15 Oct.–18 Nov.), Hill made no specific reports on palms although he described the vegetation at many locations in broad themes of agricultural and pastoral capabilities.

Queensland North-East Coast Expedition, second stage

Following reorganisation of the expedition, they departed Cardwell (18 Nov.) to complete the remainder of their explorations, which were to visit areas to the north which showed promise but which they had not been able to explore on the previous portion of the expedition. The Russell River was entered (18 Nov.) and they sailed upstream to the junction with the Mulgrave. The night camp was set up on the Frankland Islands where they were becalmed (19–20 Nov.). On the return of suitable sailing conditions they again entered the Russell River and travelled up it and the Mulgrave River to the limits of navigation (20–25 Nov.).

The ascent of Bellenden Ker Range

For this part of the expedition, discrepancies exist between the dates in the various reports but I have followed those given by Hill (1874c).

In what was to be the most productive botanical venture of the entire expedition, Dalrymple (1874):

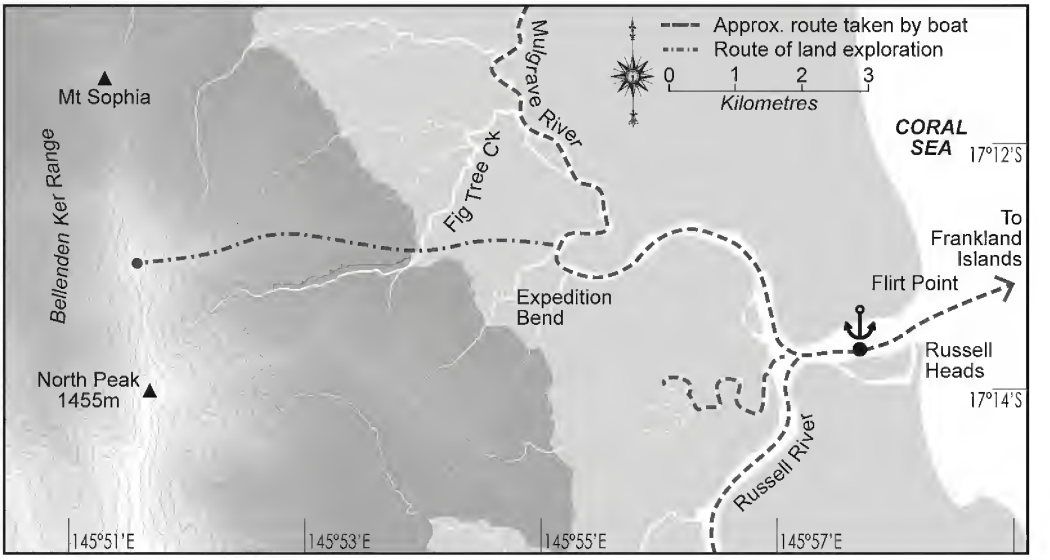
> decided upon despatching Mr. Johnstone and Mr. Hill, with eight troopers, to ascend the mountain [Bellenden Ker Range] on the following morning [26 November], every necessary preparation was completed that night. Rations for five days were divided and packed in eight canvas haversacks, which I had made for the purpose, to be carried by the troopers. They also carried some machetes for cutting through the dense jungle, canvas water bags to carry a supply of water for camping on the higher spurs and summits of the range, their rifles, and ammunition.

The party was boated upstream on the Mulgrave River to Expedition Bend [near Deeral Landing] (**Map 2**), Hill (1874c) writing that:

> on the 26th November, a party, consisting of Sub-Inspector Johnstone, myself and eight native troopers, started to ascend Bellenden-Kerr, by what appeared to be a promising leading spur.

Hill described the first section of about two miles [3.2 km] as:

> low ground, which after much wet weather must become a swamp. The vegetation consisted of the *Barringtonia careya*, F.M. [*Planchonia careya* (F.Muell.) R.Knuth]; *Ptychosperma alexandrae*, F.M. (the Alexandra palm) [*Archontophoenix alexandrae*], *Calamus australis*, Mart. (Lawyer Cane), *Bambusa arundinaceae*, Retz (Bamboo cane) [*Mullerochloa moreheadiana* (F.M.Bailey) K.M.Wong], *Pandanus aquaticus*, F.M. (Screw



Map 2. Estimated exploration route of the ascent of Bellenden Ker Range during the North-East Coast Expedition 1873. Prepared by Claire Burton, Cairns Regional Council.

> pine) [*P. solmslaubachii* F.Muell.], &c., &c. Whilst on the higher portion of the ground were *Wormia alata*, R.B. [*Dillenia alata* (R.Br. ex DC.) Martelli]; *Dysoxylon oppositifolium*, F.M. [*D. oppositifolium* F.Muell.]; *Aglaia elaeagnoidea*, Benth, Lawyer cane, Bamboo cane, Screw pines, and others.

During this section they crossed a broad creek at a place that Hill called Davy's Crossing and informally named the stream as 'Bellenden River', present-day Fig Tree Creek. Hill noted that 'the bed was filled with large granite boulders, many of which were covered with a creeping fern (*Hymenophyllum demissum*, Swartz).' Trees along the banks included '*Castanospermum*, *Eugenia*, *Brucea*, *Ximenia*, *Elaeocarpus*, *Owenia*. &c., &c.'.

Upon ascending the leading spur and setting up camp for the first night, Hill wrote that:

> it took us four and a-half hours to make a distance of one and a-half miles [2.4 km], through a complete mass of bamboos, lawyers, and screw pines; and then camped for the night on a small incline between two ridges at an elevation of only 1,250 feet [380 m].

Plants in the vicinity of the camp were:

> *Erioglossum edule,* Bl.; *Cupania robertsonii* [*Rhysotoechia robertsonii* (F.Muell.) Radkl.], F.M.; *Atalaya salicifolia*, Bl.; *Harpullia leichhardtii*, F.M.; *Castanospermum australe*, Cunn.; *Mimusops parvifolia*, Br.[*Mimusops elengi* L.]; *Achras pohlmaniana*, F.M. [*Planchonella pohlmaniana* (F.Muell.) Pierre ex Dubard], &c., &c. The thick growth of the *Pandanus* was not one of the least obstacles we had to encounter in the ascent. There were here one tree fern (*Alsophila rebeccae*, F.M.) [*Cyathea rebeccae* (F.Muell.) Domin] and also the fine climbing fern (*Gleichenia hermannii*, R.B.) [*Dicranopteris linearis* (Burm.f.) Underw.], which runs up to a height of fifty or sixty feet, and extends so much that in places we had to cut our way through it.

On the following morning (27 Nov.) they continued the ascent and Hill noted that the:

> bamboos continued until we had reached an altitude of two thousand feet [610 m]. We still had to make a road through the lawyer cane, and *Pandanus*, the walking-stick palm (*Areca monostachya*) [*Linospadix* spp.] also growing thickly. It was at this height that I met with two new species of palm. One [*Oraniopsis appendiculata* (F.M.Bailey) J.Dransf., A.K.Irvine & N.W.Uhl] was a beautiful plant about twenty feet [6 m] high with leaves or fronds twenty feet [6 m] long, and the stems about

> nine inches [23 cm] in diameter. This not being the right season to obtain either flower or fruit, I was, unfortunately unable to name the palm. The other is, I believe, a *Kenti* [*Laccospadix australasicus* H.Wendl. & Drude]; it is about twelve feet [4 m] in height, and three inches [8 cm] in the diameter of the stem, with suckers shooting from the bottom. I also noticed a new orchid (*Anoectochilus*) and a small tree fern (*Alsophila Robertsiana*) [*Cyathea robertsiana* (F.Muell.) Domin] that I had before observed on the Moresby River. The tree fern (*Alsophila Rebeccae*) was the most difficult to get through, being entangled with *Smilax elliptica,* R.Br., [*Smilax australis* R.Br.] and *Flagellaria indica*, Willd, &c.

Hill's reports on the palms *Oraniopsis appendiculata* and *Laccospadix australasicus* were the first reports of these two species, although the latter had been previously collected by Dallachy in 1866 at 'Rockingham Bay' (Dowe 2010). Hill did not proceed with or initiate any taxonomic description of these new palms. They set up their second camp during the day, 'at a height of 1,700 feet [520 m], being only 500 feet [152 m] higher than we were on starting in the morning'. From here they attempted to reach the summit, but only managed to get to an altitude of about 3,300 feet [1005 m] before night-fall forced them to descend to their camp. Near the camp, Hill observed a 'superb Proteaceae tree [*Alloxylon wickhamii* (W.Hill ex F.Muell.) P.H.Weston & Crisp], about sixty feet [18 m] in height, with glorious crimson blossoms'.

He went on to note that they:

> had to contend with the *Calamus*, *Pandanus*, and the *Alsophila rebeccae* was the greatest annoyance we met. On our way up we passed a new species of *Dammara* [*Agathis* sp.]. Also a *Podocarpus*, both small trees and not in fruit.

Hill also noted an abundance of *Moriea robinsoni* [*Helmholtzia acorifolia* F.Muell.] and the *Kenti* [*Laccospadix australasicus*], of which neither was in flower.

The following day (28 Nov.), they again attempted to reach the summit along the crest of a rocky ridge, noting that the trees and shrubs were stunted. Hill wrote that they took three hours to reach the foot of the last incline which he estimated was 800 ft [240 m] from the summit. Resting at this place, Hill:

> found a very handsome tree fern [*Dicksonia herbertii* W.Hill], a botanical description of which is given below [see Hill 1874b]. It was about 40 feet [12 m] high, and twelve inches [30 cm] in diameter four foot [1.2 m] from the ground. The stem has a singular red appearance, as have also the fronds, which are clothed with bristles. I procured four plants of it.

At his location he found *Moriea robinsoni* [*Helmholtzia acorifolia*] in flower, and noted that:

> the beautiful palm [*Oraniopsis appendiculata*] I noticed on the previous day; it is from forty to sixty feet [12–18 m] in height; no flower or fruit was to be seen; I obtained two young plants with difficulty as they appear to be scarce, probably because the fruit is a favorite food with some birds or other animals. We reached the top of the range about noon.

On the summit crest, Hill noted that it was

> covered with stunted trees and shrubs. During our short stay – an hour – I collected the following: - *Helicia ferruginea*, F.M. [possibly *Orites fragrans* F.M.Bailey]; *Carnarvonia araliifolia*, F.M.; *Pittosporum ferrugineum*, Ait.; *Bursaria spinosa*, Caron; *Melaleuca foliolosa*, Cun. [possibly *Leptospermum wooroonooran* F.M.Bailey]; *Trochocarpa laurina*, R.B. [probably *T. bellendenkerensis* Domin]; *Alsophila rebeccae*, F.M. [*Cyathea rebeccae*]; *Tmesipteris tannensis* Bhdi [probably *T. truncata* (R.Br.) Desv.]; *Kenti* [*Laccospadix australasicus*], *Tradescantia* [*Aneilema*], &c., &c..

At the highest point reached 'the aneroid barometer showed that we were 5,300 feet [1615 m] above the level of the sea'. This height is inaccurate, as the highest point on the Bellenden Ker Range is at Centre Peak some 2.5 km to the south, at 1582 m elevation. Hill noted that the summit was covered in cloud and mist and 'so thick that I could not proceed any distance to collect'. It can be assumed that they could not gain a true visual idea of their location with regard to proximity to higher points, but they could only guess if they were at the highest point. From an estimate of possible tracks, terrain and travel time, the highest point they may have reached was an unnamed peak, at about 1250 m elevation about 2 km north of North Peak (**Map 2**). This differs from the proposal by Lavarack (2015) in which it was claimed that

the party ascended to as far as North Peak. An assessment of the terrain and travel times precludes this estimation, though the actual route taken and the location of camp sites are at best an educated guess considering the discrepancies that exist between the reports of Hill (1874c) and Johnstone (1874).

After only one hour on the summit ridge, they descended to the foot of the incline to set up camp where they spent the night (28 Nov.). At this third camp Hill:

> saw a fine specimen of *Platycerium alcicorne* var. *unique* [*Platycerium hillii* T.Moore], and a splendid tree, one of the *Dammara* [*Agathis* sp.], which could not be less than one hundred and twenty feet in height, with a barrel four feet through... there were several lofty trees about the place, amongst which I noticed *Cardwellia sublimis*, F.M., *Darlingia spectatissima*, F.M. [*Darlingia ferruginea* J.F.Bailey], *Elaeocarpus foveolatus*, F.M., also others whose name I could not determine, through being unable to obtain specimens. I gathered some seeds of *Erioglossum edule*, Bl., and of *Kenti* [*Laccospadix australasicus*], and a few of *Areca minor* [possibly *Linospadix palmerianus* (F.M.Bailey) Burret]. There were scarcely any plants in flower or fruit.

They started the descent at 6.00 am (29 Nov.), with their first stop on a crest at about 9.00 am to take observations. Hill wrote that he 'gathered all that was to be had in leaf, flower, or fruit' during this respite. From the location, views were obtained of the Mulgrave River and Trinity Inlet. About half an hour after leaving the observation point:

> a thunder storm, accompanied by a heavy fall of rain, broke upon us and put a stop to all collecting; hiding from view even the tops of the trees. We had some difficulty in finding the beautiful Proteaceae tree [*Alloxylon wickhamii*] we saw when ascending the range, but fortunately managed to come across it again, and secured specimens.

The party rendezvoused with the awaiting whaleboat at Expedition Bend, and they were on board the *Flirt* by 6.30 pm of the same day.

Continuation of the Expedition

The expedition continued with further exploration of the Russell River (30 Nov.–4 Dec.). Upstream of Cowrie Point, Hill wrote that 'the principal trees, &c., are *Cardwellia*, *Grevillea*, *Aleurites*, *Bambusa* [*Mullerochloa*], *Calamus*, *Musa*, *Hellenia* [*Alpinia*], &c., &c'. The area proved botanically interesting to the whole expedition party, with Dalrymple naming Crinum Lily Creek, for the abundance of lilies, and Olfersia Creek, for ferns which adorned its course; however, neither of these names are in current use.

Departing Russell River (4 Dec.), camps were made on Fitzroy Island (4–5 Dec.), Mossman River (5–6 Dec.), and the Daintree River (6–10 Dec.). The Daintree River (named then by Dalrymple) was previously unexplored, so some time was spent in reaching the limit of navigation and assessing the surrounding country for agricultural potential. At about 16 miles [26 km] upstream of the Daintree River estuary, Hill wrote that:

> the mangrove is replaced by the *Hibiscus*, and the land is densely covered with tropical vegetation, consisting chiefly of the genera *Mimusops*, *Wrightea*, *Cordia*, *Cocos* [*Normanbya*], *Costus*, with numerous other trees and shrubs, &c., peculiar to the district.

Hill's observations and collections of what he described as *Cocos normanbyi* [*Normanbya normanbyi*] was the first record of this species which is prevalent on the banks of the Daintree River and areas further north (Hill 1874b).

After departing the Daintree River (10 Dec.) the expedition turned south to visit Fitzroy Island to collect water, and camp was made on Frankland Island No. 1 [Russell Island] (then informally named Cocoanut Island by Dalrymple because of the coconuts on the south-east corner of the island) for the night (10–11 Dec.). Hill commented on changes he observed at Fitzroy Island since he first visited in 1862, noting that the Livistonas had been cut down, writing that the:

> wanton injury that has been perpetrated, for the many handsome tree-palms (*Livistonia inermis* [*Livistona muelleri*]) which used to adorn the lightly-clad forest ridges, all have been destroyed, with one exception.

A reason for the palms demise was not proffered. After the Frankland Island camp was vacated (11 Dec.), they visited the

Johnstone River (11–17 Dec), Mourilyan Harbour (17–20 Dec.) where 'Mr. Hill was landed on the north shore, under Hilda Hill, to plant cocoanuts, coffee, &c., &c.' and at 'Camp Point, with Native Mounted Police Corporal Sam and three troopers, to collect botanical specimens on Georgie Hill'. Next camps were at No. 2 South Barnard Island (20–21 Dec.), Dunk Island (21–22 Dec.) and via Hull River to Cardwell (22 Dec.). The expedition was wound down at Cardwell (23 Dec.), where 'the surplus stores and all specimens and curios, &c., &c., were landed from the schooner [*Flirt*] and she was paid off'.

Results of the North-East Coast Expedition

The North-East Coast Expedition was among Hill's most successful botanical ventures, with regard to the collection and description of new species. About 100 specimens can be attributed to this expedition, most of which were sent to Mueller in Melbourne. Of these, about 20 represent type materials (AVH 2016; Global Plants 2016) and most of the new taxa were described by Mueller (1874a, 1875), with some being published as early as April 1874, just four months after the return of the expedition to Brisbane. Six new species were described by Hill (1874b), in an appendix to his Annual Report of May 1874, with this being his single most important taxonomic endeavour. A seventh species was included among the new species, named as *Oreocallis wickhamii* W.Hill [*Alloxylon wickhamii* (W.Hill & F.Muell.) P.H.Weston & Crisp], but it had been previously published as *Embothrium wickhamii* W.Hill ex F.Muell, in April 1874, therefore predating Hill's name by one month. The appendix also included the protologues of two new palms, *Areca minor* W.Hill [*Linospadix minor* (W.Hill) Burret] and *Cocos normanbyi* W.Hill [*Normanbya normanbyi* (W.Hill) L.H.Bailey], as well as a new fern, *Dicksonia herbertii* W.Hill, an orchid, *Dendrobium nindii* W.Hill and two bananas, *Musa jackeyi* W.Hill and *M. charlioi* W.Hill. As with the Cape York Expedition of 1862, Hill also collected seeds and seedlings which he propagated and grew at BBG.

Despite the new botanical discoveries made by Hill on the Bellenden Ker Range, he regretted the lack of any 'valuable botanical discoveries' from the viewpoint of large numbers of specimens. Hill explained his perceived short-comings:

> by the fact that for three out of four days for which the party was provisioned, we had to cut a pathway the whole distance along a razor-back ridge, in many places only eighteen inches in diameter.

He otherwise noted that he secured 'some species that are new, and several others that are rare and interesting'.

Hill's attempt at taxonomy unfortunately did not engender much confidence from other taxonomists. Mueller (1874b), in a letter to Edward Ramsay, 24 July 1874, wrote that:

> Mr Hills recent Report on the bot. Garden of Brisbane, which document you likely will have seen, has appended to it descriptions of two supposed new Palms, namely *Areca minor*, a tufty palm only 2–5 feet high, from Moresby & Russell River and the Bellenden Ker Ranges fruit nearly 1" long reddish; – the *Cocos normanbyi*, 60 feet high from the Daintree-River. I am however satisfied, that Mr Hill, though he ventured to send the palms out as novelties in an official document, has not sufficient literary means and knowledge to ascertain the exact specific or even generic position of such palms.

In a subsequent letter from Hill (1874d) to Mueller, 18 August 1874, Hill, with reference to his attempt at generic positioning for the palms, wrote that he had sent Mueller:

> a small tin box containing one seed of the *Cocos*, and some of the *Areca*. I have no doubt but what you will be able to make the latter to be another genera. Both fruits are red when ripe. I have had them in spirit of wine'.

After receiving the seeds, Mueller (1874c) wrote to Edward Ramsay, 9 Sept. 1874, stating that he had 'saved' Hill's palm names from taxonomic obscurity, in that:

> when Mr Hills palm fruits arrived, that his supposed *Cocos*! is an *Areca,* near the common Indian Betel nut (*A. catechu*), and his supposed *Areca* is a true *Kentia.* It is singular, that he should venture to send descriptions almost of no diagnostic value and on such ill digested data, as he obtained, into an official report. To protect him to some extent, I have

> placed his name along with mine as authority of the Normanby palm, so that his dedication may not be destroyed; and that is more than likely anyone else would have done for him! Pray do not mention this to any one, until you get the new number of the fragmenta, which is printed, but not yet issued.

Mueller redesignated Hill's palms into what he considered to be their correct genera, and in all cases cited Hill as the original author. He moved *Areca minor* into *Kentia*, creating *K. minor* (W.Hill) F.Muell, (Mueller 1874d) and later as *Bacularia minor* (W.Hill) F.Muell. (Mueller 1878) [*Linospadix minor*]. For *Cocos normanbyi*, Mueller moved it into *Areca*, as *A. normanbyi* (W.Hill) F.Muell. (Mueller 1874d), and later as *Ptychosperma normanbyi* (W.Hill) F.Muell. (Mueller 1878) [*Normanbya normanbyi*]. Hill made neither subsequent attempts at taxonomic publishing, nor any reference to taxonomy as such in any of his annual reports.

Walter Hill's obscure palm names

The only other publication by Hill which can be interpreted as having taxonomic implications for palms was the *Catalogue of Plants Growing in the Queensland Botanic Gardens*, in which Hill (1875b) introduced two new palm names, *Pinanga smithii* W.Hill and *Sagus blackallii* W.Hill (**Table 2**). These and other novel names were applied by Hill to specimens (also in other families) that he had collected during his travels and had subsequently grown in BBG; however, these are invalid names as publication criteria were not met (Dowe 2004). Other new palm names were introduced by Hill arbitrarily in his annual reports, including *Ptychosperma kennedyana* W.Hill (Hill 1879) and *P. hillii* (Hill 1880a), neither of which can be related to any known taxa. A further name, *Areca northiana* W.Hill ex Hemsl., was associated with a palm that the English botanical artist Marianne North painted in the BBG when she visited in 1880 (North 1892). The name was cited in a caption for the painting in the published catalogue of North's paintings in Kew Gardens (Hemsley 1882) (**Table 2**).

Table 2. Palms observed, described and/or collected by Walter Hill during the Cape York Expedition of 1862.

Current name	Hill's nomenclature	Location
Arenga australasica	*Sagus farinifera* and *Sagus blackallii*	Mt Bremer and Evans Bay
Calamus aruensis	*Zalacca* sp.	near Somerset
Caryota albertii	*Caryota urens*	Evans Bay and near Somerset
Hydriastele costata	*Pinanga* sp.	near Somerset
Hydriastele wendlandiana	*Areca* sp.	near Somerset
Calamus australis	*Calamus australis*	Fitzroy Island
Ptychosperma elegans	*Seaforthia elegans*	Evans Bay, near Somerset and Fitzroy Island
Livistona muelleri	*Livistona inermis*	Fitzroy Island

Conclusion

Although Hill's primary contribution to Queensland was through horticulture, he was sometimes not so highly regarded by his contemporaries in that area. Of the BBG, Bancroft (1879) wrote that 'scarcely anything can be said in praise' and that Hill was 'a man of little polish, harsh to his workmen, who are repeatedly changed. Yet, with all his faults, he has done many useful things'. He was otherwise supported by others who applauded his attempts at facilitating a sugar industry in

Queensland (Anon. 1870), in his horticultural expertise in the BBG (Rodeur 1871), and as a horticultural pioneer in Queensland (see Hill 1860b, 1862d, 1862–1882). Some thought he was unfairly criticised and that he received little support from the Government compared to other botanic gardens directors (Censor 1880). Frederick Manson Bailey gave only scant acknowledgement to Hill's work as a collector and taxonomist (e.g., Bailey 1878), and in Hill's obituary described him as 'more of a gardener than a botanist' (Bailey 1904). Hill's attempts at taxonomy were disparaged by Mueller who was particularly critical of Hill's palm taxonomy (Mueller 1874b, c), noting that Hill did not have the ability to undertake taxonomic work. Mueller claimed to have 'saved' Hill's new palm species from 'obscurity' when he placed Hill's species into their 'correct' generic positions but otherwise, though guardedly, retained Hill as first author and with himself as revising author. The desire to achieve scientific outputs, in the sense of independent publications and empirical research, appear not to have been a part of Hill's *modus operandi*.

Despite his shortcomings as a taxonomist, Hill's contribution to the fledgling colony of Queensland was significant, particularly during the early days of his appointments through his roles as Director of Brisbane Botanic Garden, Colonial Botanist and Selector of Agricultural Reserves. Hill (1873) articulated his aspirations, when he wrote that:

> I have considered it my duty to devote my best energies, because in so young a colony as this the introduction of new plants of use within Queensland, or of ornamental value otherwise, ought to be a leading object with institutions such as the one of which I have the control.

It appears that the quality of Hill's work declined toward the end of his career, to the point of his termination by enforced retirement in 1881 by the Secretary of Lands, and with accompanying accusations of theft and wilful damage (Legislative Assembly 1881). The accusations were 'proved' and accepted by a board set up to investigate the matter but no action was taken by the Government on their decision (Brisbane Courier 1881). Hill retired on a pension to his property Canobie Lea south of Brisbane where he propagated and grew tropical fruits (Queenslander 1904; McKinnon 2009).

Overall, Hill's contribution to Australian palm botany was relatively meagre. However, he was more than capable of distinguishing new species in the field, providing descriptive accounts, and detailing the use of palms in some of his reports (Hill 1862c, 1880b). Hill was instrumental in introducing numerous new palm species into the gardens of Queensland, and established Brisbane Botanic Garden as one of the most important and influential gardens in regards to palms and their cultivation in Australia, a legacy that continues into the present.

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Three new species in *Lindernia* All. *s.l.* (Linderniaceae) for Australia

B.S. Wannan

Summary

Wannan, B.S. (2016). Three new species in *Lindernia* All. *s.l.* (Linderniaceae) for Australia. ***Austrobaileya* 9(4): 508–523.** Three new species from the genus *Lindernia* are described: *L. stantonii* Wannan, *L. beasleyi* Wannan from northern Queensland (Cape York Peninsula), and *L. barkeri* Wannan from northern Western Australia (Kimberley). Illustrations of flowers, fruits, seeds, leaves, stem anatomy, type specimen and a distribution map are provided for all species. Notes on habitat and conservation status are also provided for each. A key to Queensland species is provided.

Key Words: Linderniaceae, *Lindernia*, *Lindernia barkeri*, *Lindernia beasleyi*, *Lindernia stantonii*, Australia flora, Queensland flora, Western Australia flora, wetland plants, new species, taxonomy, identification key, seed morphology, stem anatomy

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Introduction

The genus *Lindernia* All. (Linderniaceae Borsch, K.Müll. & Eb.Fisch.) is a pan-tropical genus represented in Australia by approximately 50 species. *Lindernia* species have been collected and described in Australia for over 200 years in regional floras (Stanley & Ross 1986; Barker 1992a; Cowie *et al.* 2000), state floras (Bailey 1901; Ewart & Davies 1917; Barker 1992b) and national floras (Brown 1810; Bentham 1868). Australian *Lindernia* species have also been described in a Malesian revision (Philcox 1968) and a recent revision of the subgenus *Bonnaya* (Liang & Wang 2014). Species continue to be discovered and added to the Australian flora by descriptions of new taxa (Barker 1990, 1998) and by identification of previously unrecognised taxa (Wannan 2013). In spite of this work, many species are yet to be formally named, especially those from the Northern Territory and no overall account of the Australian species is available.

The current paper describes three new species for Australia: two from Cape York Peninsula (northern Queensland) and one from the Kimberley (northern Western Australia). The Kimberley species was treated as *Lindernia* sp. A by Barker (1992a). The new species are described under the genus *Lindernia* as the generic boundaries proposed by Fischer *et al.* (2013) are not well supported by molecular studies of Australian species (Wannan *et al.* unpubl.).

Materials and methods

The species descriptions are based on herbarium specimens (BM, BRI, CANB, CNS, DNA, MEL, PERTH, UNSW), spirit material (BRI and the author's own collections), and examination of fresh material collected by the author. Length by width measurements in mm are indicated as length × width mm. Images of seeds are provided from scanning electron microscopy (SEM) at the Australian Museum, Sydney. Images from stem anatomy were obtained from freehand sections by the author and stained with Toluidine blue. An abbreviation used in the specimen citations is NP for National Park.

Taxonomy

A key to formally described Queensland species is provided below. A key to Western Australian *Lindernia* is provided in Barker (1992a).

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Key to Queensland *Lindernia* species

1 Capsule > 2× length of calyx, cylindrical or fusiform **2**
1. Capsule < 2× length of calyx, globose or ovoid **5**

2 Flowers axillary, 1 per axil (i.e. no differentiation between leaves & floral bracts) **3**
2. Flowers in a loose raceme (i.e. floral bracts much smaller than leaves) **4**

3 Upper stamens only, anthers without tails, leaf length < 3× breadth, pedicel 5–11 mm . . . . . **L. antipoda**
3. Upper & lower stamens, anthers with tails, leaf length > 3× breadth, pedicel 15–20 mm . . . . . **L. anagallis**

4 Leaves crenate with aristate margins, calyx 4.5–6 mm, corolla white with purple spots . . . . . **L. ciliata**
4. Leaves crenate without aristate margins, calyx 3–3.5 mm, corolla pink. . . . **L. tenuifolia**

5 Fertile upper stamens only **6**
5. Fertile upper & lower stamens **7**

6 Leaves with 3–5 longitudinal veins, corolla 5–6.5 mm long, no internal flaps in corolla. . . . . **L. hyssopioides**
6. Leaves with midvein only, corolla 10–13 mm long, stamens enclosed by flaps in corolla. . . . . **L. tectanthera**

7 Leaves ovate with 3–5 longitudinal veins, ... **8**
7. Leaves subulate with a single midrib or no visible midrib,. **10**

8 Leaves, pedicel and calyx with filamentous eglandular trichomes. **9**
8. Leaves, pedicel and calyx without filamentous eglandular trichomes (sometimes with stalked-glandular or sessile-glandular trichomes) . . . . . **L. alsinoides**

9 Calyx lobed to base at anthesis, 1–3 flowers per axil. . . . . **L. pusilla**
9. Calyx fused for greater than ¼ of length at anthesis, 1 flower per axil . . . . .**L. crustacea**

10 Erect herbs with terminal cluster of flowers, pedicels < 10 mm long **11**
10. Decumbent herbs with flowers in axils, pedicels > 10 mm long **12**

11 Corolla < 7 mm long, with no staminal appendages . . . . . **L. aplectra**
11. Corolla > 9 mm long, with appendages on lower stamens. . . . . **L. stantonii**

12 Corolla with spotted lower lobes, ovary without stalked-glandular trichomes, pedicels 31–63 mm with stalked-glandular trichomes, calyx 2.5–4 mm long . . . . . **L. beasleyi**
12. Corolla without spotted lower lobes, ovary with stalked-glandular trichomes, pedicels 20–43 mm without stalked-glandular trichomes, calyx 4–5 mm long . . . . . **L. subulata**

Lindernia stantonii Wannan **sp. nov.** Similar to *L. aplectra* W.R.Barker but differs in its possession of appendages on its lower stamens (versus appendages absent), presence of stalked glandular trichomes on the ovary (versus absent), longer pedicels (2–7 mm versus 1–3 mm), longer corolla (9–15 mm versus 5–7 mm), shorter leaves (0.5–2.5 mm versus up to 12 mm), seed size (*c.* 0.35 × 0.2 mm versus *c.* 0.6 × 0.35 mm) and seed ornamentation (absence of regular fence-like pattern versus presence). **Typus:** Queensland. Cook District: Road to Pormpuraaw, 12 June 2008, *B.S. Wannan 5243 & P. Graham* (holo: BRI; iso: CNS).

Lindernia sp. Hann River (J.R. Clarkson 7953); Fechner (2007: 188, 2014: 24).

Annual herb; stems erect, scape-like, rigid, 10–35 cm high, glabrous, green or sometimes red-purple. **Leaves** cauline, opposite, simple, subsessile, triangular and scale-like, 0.5–2.5 mm × 0.2–0.5 mm, glabrous; margins entire; single midvein obscure. **Flowers** crowded at the apex of stems, subtended by leaves that occasionally have stalked glandular trichomes; pedicels ascendent, 2–7 mm long with stalked glandular trichomes. **Calyx** divided to base, lobes triangular-lanceolate, 2.5–3(–4) × *c.* 0.5 mm, green, with stalked glandular trichomes, 3-nerved. **Corolla** 9–15 mm long; white, cream or mauve or yellow, with stalked glandular trichomes outside, internal flaps absent; tube 4–9 mm long, upper lobe porrect, emarginate, 2–2.5 mm long; lower lip 3-lobed, 4–6 mm long, reflexed downwards. **Upper stamens** 2 fertile, each with 2 cells; filaments 1–2 mm long; anthers cohering with cells 0.5–0.8 mm long, apiculate. **Lower stamens** 2 fertile, each with 2 cells; filaments 3–6 mm long; anthers cohering with cells 0.3–0.8 mm long, apiculate, one of each pair smaller. Staminal appendage simple, 0.5–0.8 mm long, included within the throat and with bullate trichomes. **Ovary** 1–1.5 mm long, with stalked glandular trichomes in upper half; nectariferous disc undulate around base of ovary; style 6–10 mm long, with sparse stalked glandular trichomes. **Fruit** with erect pedicels 5–7 mm long, with stalked glandular trichomes; calyx 3–4 mm long; capsule globular, 3–3.5 mm long, with stalked glandular trichomes at apex. **Seeds** rhomboidal, *c.* 0.35 × 0.2 mm, surface with 4 ridges in tranverse section, sulcate, light brown. **Stem anatomy** in transverse section circular with four collenchyma bundles and secondary thickening in vascular cambium; few air spaces in outer cortex. **Figs. 1–8.**

Fig. 1. ***Lindernia stantonii***. Plants with white flowers – arrows indicate minute leaves, *c.* ×2 (*Wannan 3090 & Toh*, BRI). Photo: B.S. Wannan.

***Additional selected specimens examined*: Queensland**. Cook District: Moa, Torres Strait, 3 km NNE of Kubin, May 2003, *Wannan 3090 & Toh* (BRI, NSW); Coen, Aug 1976, *Scarth-Johnson 309A* (BRI); 18 km SW of Silver Plains Homestead, Aug 1978, *Paijmans 2934* (BRI, CANB); Silver Plains, Jun 2013, *McDonald KRM14339* (CNS); Lama Lama NP, Princess Charlotte Bay, Jul 2010, *Thompson SLT1036* (BRI); Lama Lama NP, Princess Charlotte Bay, Jun 2012, *McDonald KRM13178 & Thompson* (BRI); Lama Lama NP, Princess Charlotte Bay, Jun 2012, *McDonald KRM13179 & Thompson* (CNS); 6 km N of Lilyvale on track to Running Creek, Jun 1993, *Clarkson 10094 & Neldner* (BRI, CNS); 7 km NE of Musgrave on road to Marina Plains, Jul 2000, *Wannan 1864 & Wannan* (BRI, NSW); SE of Musgrave, beside the Peninsula Developmental Road., Jun 2006, *Wannan 4518 & Graham* (BRI); Road to Pormpuraaw,

Jun 2008, *Wannan 5243 & Graham* (BRI); 20 miles [33.3 km] ENE of Musgrave Telegraph Office, Jun 1968, *Pedley 2654* (BRI); Peninsula Developmental Road, 44 miles [7.3 km] beyond Laura, Jul 1965, *Gittins 978* (BRI, CANB, NSW); 7.9 km S of Musgrave on road to Laura, Jul 1998, *Bean 13559* (BRI, MEL); 3.5 km S of the Hann River on the Peninsula Development Road, May 1989, *Clarkson 7953* (BRI, CNS); 9.7 km N of Morehead River, Jun 1989, *Clarkson 8078 & Neldner* (BRI, CNS); Rinyirru NP, 7.4 km along S boundary from Koolburra gate, Aug 2012, *McDonald KRM13417* (BRI); Lama Lama NP, Jun 2013, *McDonald KRM14459* (CNS); Lakefield NP, 35 km along Marina Plains Road from Musgrave, Jun 2011, *McDonald KRM11674* (BRI); 14 km NE of New Laura Ranger Station, Lakefield NP, May 1992, *Neldner 4023* (BRI, CNS); 25 km SE of Lakefield Ranger base, Aug 2014, *Thompson SLT14277 & Fell* (BRI); 44 km SE of Lakefield Ranger base, Aug 2014, *Thompson SLT14346a, SLT14354 & Fell* (BRI); 42 km WNW of 'Bulimba' Homestead in Staaten River NP, Apr 2004, *Fox IDF3110 & Wilson* (BRI); Staaten River NP, Jul 2004, *Williams 1652* (BRI); Staaten River NP, Jul 2004, *Williams 1654 et al.* (BRI); E of Miranda Downs Homestead, July 2001, *Thompson NOR135* (BRI).

***Distribution and habitat*:** *Lindernia stantonii* is endemic to Queensland and occurs from south-west Cape York Peninsula to Torres Strait (**Map 1**). It grows in moist sandy areas in woodland.

***Notes*:** The novelty of this taxon is corroborated by sequence data (Wannan *et al.* unpubl.). It is similar to *Lindernia aplectra* that occurs over much the same distribution range in Queensland, but differs in numerous characters given above. The Torres Strait specimen (*Wannan 3090 & Toh*) is disjunct from the remaining specimens, but its characters fall within the range of the southern elements including lighter flower colour which is typical of other specimens (e.g. *Wannan 1864*, *McDonald KRM11674*, *Thompson SLT14534*). Corolla colour varies throughout the range of this species.

***Conservation status*:** *Lindernia stantonii* has a broad range but remains infrequently collected. A status of **Least Concern** is recommended (IUCN 2001).

***Etymology*:** The species is named for Peter Stanton who has been a leader in conservation on Cape York Peninsula for over 40 years.

Fig. 2. ***Lindernia stantonii***. Lateral view of mauve flower, *c.* ×6 (*Wannan 5243 & Graham*, BRI). Photo: B.S. Wannan.

Fig. 3. ***Lindernia stantonii***. Adaxial view of mauve flower, *c.* ×5 (*Wannan 5243 & Graham*, BRI). Photo: B.S. Wannan.

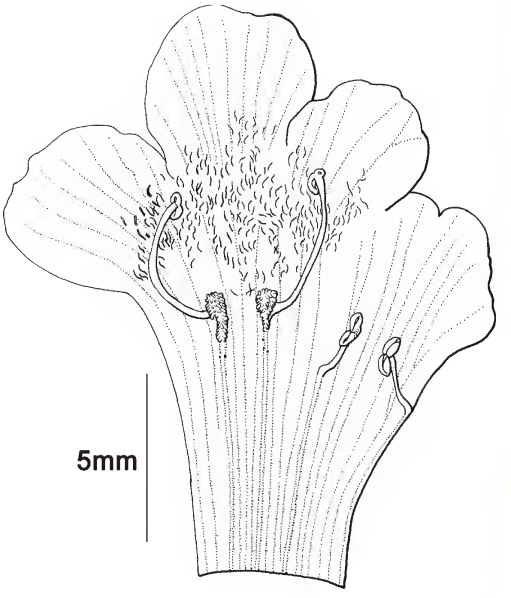

Fig. 4. *Lindernia stantonii*. Corolla opened to show stamens (*Wannan 5243 & Graham*, BRI). Del. W. Smith.

Fig. 5. *Lindernia stantonii*. Capsule, *c.* ×6.5 (*Wannan 5243 & Graham*, BRI). Photo: B.S. Wannan.

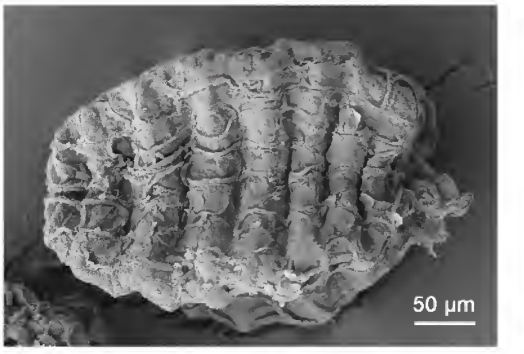

Fig. 6. *Lindernia stantonii*. SEM of seed (*Wannan 5243 & Graham*, BRI). Photo: Australian Museum.

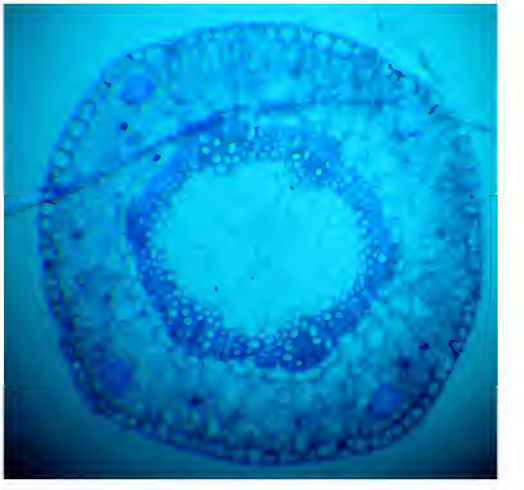

Fig. 7. *Lindernia stantonii*. Transverse stem section, *c.* ×50 (*Wannan 5243 & Graham*, BRI). Photo: B.S. Wannan.

Fig. 8. Holotype of ***Lindernia stantonii*** (*Wannan 5243 & Graham*, BRI). Photo: W. Smith.

Lindernia beasleyi Wannan **sp. nov.** Similar to some forms of *L. subulata* R.Br., but differs in having spotted lower corolla lobes, shorter leaves (3–12 mm versus 4–20 mm in *L. subulata*), longer pedicels (31–63 mm versus 20–43 mm), presence of stalked glandular trichomes on pedicels (versus absent), and absence of stalked glandular trichomes from the ovary and fruit (versus present). **Typus:** Queensland. Cook District: Merapah, 4 August 2010, *B.S. Wannan 5935* (holo: BRI; iso: CNS, NSW).

Annual herb; stems decumbent and with weakly ascending floral axes, glabrous**. Leaves** cauline, opposite, simple, 3–12 × 0.5–1.5 mm, triangular to subulate, glabrous; margins entire; single midvein often obscure; petiole absent. **Flowers** axillary, shoots sometimes terminated by a cluster of leaves and flowers; pedicels 31–63 mm long (at anthesis), ascending and with stalked glandular trichomes. **Calyx** divided to base, lobes triangular-lanceolate, 2.5–4 mm long, green, with stalked glandular trichomes, three nerved (lateral nerves often obscure). **Corolla** 11–13 mm long, purple and white, with distinctive purple spots on lower lobes; with stalked glandular trichomes externally, internal flaps absent; tube 5–7.5 mm long, upper lobe porrect, emarginate, 2.5–3 mm long, lower lip 3-lobed, 4.5–6.5 mm long, reflexed downwards. **Upper stamens** 2, each with 2 cells; filaments 1.5 mm long, anthers cohering with cells *c.* 0.5 mm long. **Lower stamens** 2, each with 2 cells; filaments 3–5 mm long; anthers cohering with cells 0.4–0.5 mm long, one of each pair smaller, both apiculate. Staminal appendage simple, 2.5–4 mm long, exceeding the throat, with bullate trichomes. **Ovary** 1–1.5 mm long, glabrous; nectariferous disc smooth around base of ovary; style 5–6.5 mm long, glabrous. **Fruit** with erect pedicels 32–73 mm long; calyx 3–4 mm long; capsule ovoid 2.5–4 mm long, glabrous. **Seeds** rhomboidal with longitudinal ridges, *c.* 0.3 × 0.2 mm, surface sulcate, brown. **Stem anatomy** in transverse section four-angled with collenchyma bundles in each corner, with separated vascular bundles; air spaces frequent in outer cortex. **Figs. 9–16.**

Fig. 9. ***Lindernia beasleyi***. Lateral view of flower, *c.* ×2.5 (*Wannan 4845 & Graham*, BRI). Photo: B.S. Wannan.

Fig. 10. ***Lindernia beasleyi***. Front view of flower, *c.* ×3 (*Wannan 5896 & Spena*, BRI). Photo: B.S. Wannan.

***Additional selected specimens examined*: Queensland**. Cook District: 2 km NE of Bamaga Airstrip, Aug 1978, *Paijmans 3012* (BRI); Between Bamaga and tip of Cape York, Sep 1980, *Scarth-Johnson 1041A* (BRI); Lake Wicheura, Cape York, Dec 2008, *Booth 5258 & Lynch* (BRI); Cape York N of Jardine River about 26 km S of Bamaga, Oct 1971, *Dodson s.n.* (BRI [AQ3598]); Cape York, *s.dat. Hartmann s.n.* (MEL 285765); Jardine River, May 1948, *Brass 18884* (BRI); Biffen Swamp *c.* 1.5 km S of Mutee Heads Turnoff on road from Bamaga to Jardine River, Aug 1985, *Clarkson 6190* (BRI, CNS); Lake Boronto, Newcastle Bay, Sep 1974, *Webb 13611 & Tracey* (BRI); Near Jacky Jacky Creek, May 1962, *Webb 6011 & Tracey* (BRI); Cape York Peninsula *c.* 50 miles [83 km] S of Cape York, 1943, *Whitehouse s.n.* (BRI [AQ36297]); Sanamere Lagoon *c.* 3 km N of Jardine River Crossing on the road to Bamaga, Aug 1985, *Clarkson 6174* (BRI, CNS); *c.* 2 km S of Ussher Point, Sep 1985, *Clarkson 6247* (BRI, CNS); Fruit Bat Falls, Mar 1992, *Johnson 5067* (BRI); SW of Somerset, Lake Bronto, Aug 1978, *Kanis 2068* (BRI); E of Vrilya

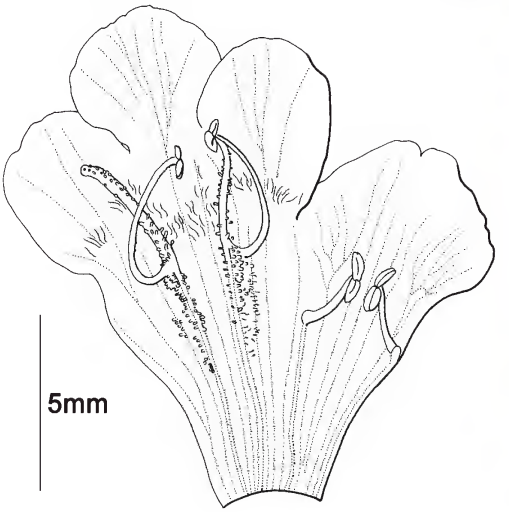

Fig. 11. ***Lindernia beasleyi***. Corolla opened to show stamens (*Wannan 5935*, BRI). Del. W. Smith.

Fig. 12. ***Lindernia beasleyi***. Leaf, 4-angled stem and base of pedicel, *c.* ×7 (*Wannan 5896 & Spena*, BRI). Photo: B.S. Wannan.

Fig. 13. ***Lindernia beasleyi***. Capsules, *c.* ×7 (*Wannan 5944 & Beasley*, BRI). Photo: B.S. Wannan.

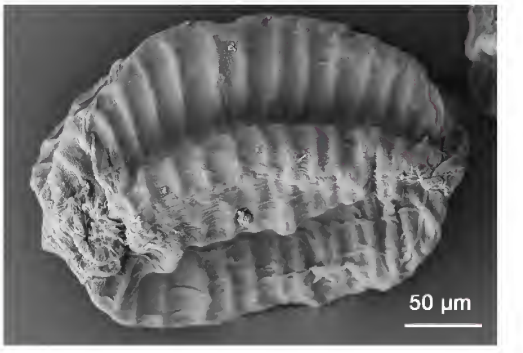

Fig. 14. ***Lindernia beasleyi***. SEM of seed (*Wannan 5896 & Spena*, BRI). Photo: Australian Museum.

Point, Aug 1981, *Morton AM1404 & Godwin* (CNS), Heathlands, Oct 2004, *Fensham 5125 & Jensen* (BRI), Bertie Creek, Sept 1989, *Jobson 786 & Power* (MEL), Bertie Creek, Peninsula Developmental Road, May 1980, *Morton AM920* (CNS), 58 miles [96.6 km] by road N of Moreton towards Jardine River, Aug 1973, *Brooker 4085* (BRI), Orchid Swamp, 2.6 km by road from Coolibah Ranger Station, Steve Irwin Wildlife Reserve, Jun 2011, *McDonald KRM11520 & Lyon* (BRI), *c.* 8 km S of White Point on southern End of Shelburne Bay, Oct 1991, *Clarkson 9147 & Neldner* (BRI), 1 km NE of Middle Peak, Shelburne Bay Area, Jun 2008, *Forster PIF33715 & McDonald* (BRI), Namaleta Creek, E Arm upstream of Venture Mine Lease, Oct 1994, *Gunness AG2403* (BRI), Namaleta Creek, E Arm Drainage Basin upstream of Venture Mine Lease, Oct 1994, *Gunness AG2391* (BRI), *c.* 2.5 km W of Crossing on Glennie Creek on track from Bromley to Bolt Head, Jul 1990, *Clarkson 8760 & Neldner* (BRI), Frenchmans Track between Wenlock & Pascoe Rivers, Sep 2007, *Wannan 4845 & Graham* (BRI), *c.* 50 km NE of Weipa, Jul 2010, *Mitchell 190* (BRI), 'Batavia Downs', 4 km W by road of 'Bromley' Homestead, Cape York Peninsula, Jun 2007, *Forster PIF32613 & McDonald* (BRI), 13.5 km ENE of Weipa Mission, Jul 1974, *Specht W417 & Salt* (BRI), N of Mt Tozer, Cape York Peninsula, Jul 2004, *Wannan 3671 et al.* (BRI), Beening Creek, Weipa, Jul 1984, *Gunness AG1870* (CNS), *c.* 26 km SSW of Aurukun & 3 km W of Archer River, Oct 1982, *Clarkson 4550* (BRI, CNS), 48 km ESE of Aurukun, Yuukingga Nature Refuge, May 2016, *Wannan 6784 & Mitchell* (BRI); Road to Pormpuraaw, Jun 2008, *Wannan 5240 & Graham* (BRI, NSW), Eight Mile Creek, Dixie Station, Aug 2008, *McDonald KRM7849 & Wannan* (BRI), Harkness

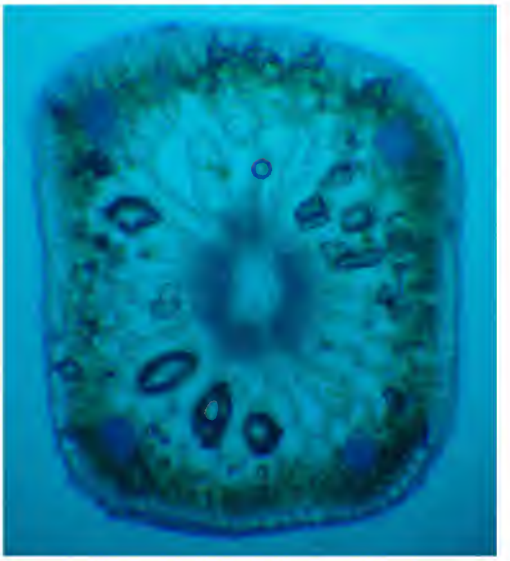

Fig. 15. ***Lindernia beasleyi***. Transverse stem section, *c.* ×65 (*Wannan 5896*, BRI). Photo: B.S. Wannan.

Station, Cape York Peninsula, Jul 2008, *Wannan 5334 & McDonald* (BRI); Rock Hole near Emu Lagoon, Errk Oykangand NP, Jun 2010, *McDonald KRM9288 & Cockburn* (BRI); W of Almaden near race track, Jul 2010, *Wannan 5896 & Spena* (CNS); Near Almaden Racecourse, Oct 2010, *Wannan 5944 & Beasley* (BRI, CNS, NSW); Mud Soak Spring, Mt Surprise, Jun 2001, *Fensham 4521* (BRI).

***Distribution and habitat*:** *Lindernia beasleyi* is endemic to Queensland where it occurs from Cape York to south-west Cape York Peninsula (**Map 2**). It grows in moist sandy areas in wetlands and woodlands.

***Notes*:** The novelty of this taxon is corroborated by sequence data (Wannan *et al.* unpubl.). It is perhaps most likely to be confused with *Lindernia subulata* that occurs over a similar distribution range, but differs in a range of characters as outlined above.

***Conservation status*:** This species has a broad range and is moderately common in appropriate habitats. A status of **Least Concern** is recommended (IUCN 2001).

***Etymology*:** The species is named for the late John Beasley whose handbooks provided accessible information on North Queensland plants.

Lindernia barkeri Wannan **sp. nov**. Similar to *L. cleistandra* W.R.Barker but differs in its more erect glabrous habit with uncrowded leaves, shorter petioles (0.5–4 mm versus 5–22 mm), entire glabrous leaves, shorter calyx (1.5–3 mm versus 2–7 mm), much shorter corolla (4.5–6 mm versus 8–18 mm), and smaller capsule (1.5–3 mm versus 3.5–5.5 mm). **Typus:** Western Australia. KIMBERLEY: Garimbu Creek, 24 June 2014, *B.S. Wannan 6687, M. Wardrop, P. Lane & H. Hofman* (holo: PERTH; iso: BRI, CNS).

Lindernia sp. A W.R. Barker; (Barker 1992a: 828, Fig. 254E).

Annual herb; stems erect, 4–16 cm high, sometimes rooting at lower nodes, glabrous, green or rarely reddish. **Leaves** cauline, opposite, simple, glabrous; blade broadly lanceolate to depressed ovate, 3–20 × 2.5–21 mm, diminishing in size up the stem, with 3–5 longitudinal veins; rounded to attenuate at base; margins entire, sinuate or rarely serrate; petiole 0.5–4 mm long. **Flowers** rarely axillary, mostly in racemes with triangular bracts 1–3.5 mm long; racemes sometimes with alternate bracts or when opposite with a single flower per node; pedicels erect 4–12 mm long, glabrous. **Calyx** deeply 5-lobed, almost to the base, triangular-ovate, lobes 1.5–3 mm long, acuminate, 1 or 3 nerved, with minute eglandular hairs. **Corolla** 4.5–6 mm long, white or mauve or pink; tube 2–4 mm long, externally with stalked glandular trichomes; upper lip porrect, *c.* 0.5 mm long, truncate, internally with longitudinal flaps enclosing the upper anther filaments; lower lip 3-lobed, 1.5–3 mm long, mid-lobe longer than lateral lobes, with the two laterals held at right angles to the mid lobe. **Upper stamens 2**, each with 2-cells**,** enclosed by the corolla flaps; filaments 0.8–1 mm long; anthers cohering, *c.* 0.5 mm long, the cells divergent. **Lower stamens** sterile represented by two short (*c.* 0.5 mm long) staminodes that are either linear or slightly clavate at the apex. **Ovary** *c.* 1.5 mm long, glabrous; style *c.* 2.5 mm long, glabrous. **Fruit** with pedicels to 25 mm long, calyx 1.5–3 mm long, capsule 1.5–3 mm long. **Seeds** cuboidal, *c.* 0.35 × 0.25 mm with 4 longitudinal angles

Fig. 16. Holotype of ***Lindernia beasleyi*** (*Wannan 5935*, BRI), sheet 1 of 2. Photo: W. Smith.

Fig. 17. Holotype of ***Lindernia beasleyi*** (*Wannan 5935*, BRI), sheet 2 of 2. Photo: W. Smith.

and transverse ridges, light brown. **Stem anatomy** in transverse section four-angled with collenchyma bundles in each corner, with separated vascular bundles; air spaces uncommon in outer cortex. **Figs. 18–25.**

***Additional selected specimens examined*: Western Australia**. KIMBERLEY: Mt Hart Station, Jun 2002, *Wannan 2476* (BRI, PERTH); Tributary of Garimbu Creek, Jun 2014, *Wannan 6681 et al.* (CNS, NSW, PERTH); Gorge in Garimbu Creek, Jun 2014, *Wannan 6686 et al.* (CNS); tributary of Roe River, Jun 2014, *Wannan 6688 et al.* (CNS, PERTH); *c.* 1 km upstream of King Cascade, Prince Regent River, Feb 1999, *Barrett 715 & 716* (PERTH); *c.* 1 km E of falls at head of N arm of Bachsten Creek, Jan 1999, *Barrett 678* (PERTH); Upper Prince Regent River, 3.5 km E of Mt Agnes, Feb 2001, *Barrett 1044* (PERTH); Cypress Valley, beside Morgan River, S of New Theda Homestead, Jan 2001, *Barrett 1113* (PERTH); Breakfast Creek flowing S into Charnley River, Jun 1993, *Edinger 843* (PERTH).

***Distribution and habitat*:** *Lindernia barkeri* occurs in the Kimberley of Western Australia (**Map 3**) and grows in wet sandy soil under sandstone overhangs or in the drip lines of cliffs, often in association with *Stylidium muscicola* F.Muell.

***Notes*:** The novelty of this taxon, first proposed by Barker (1992a), is corroborated by its sequence data (Wannan *et al.* unpubl.) and although its leaf shape is similar to *Lindernia cleistandra* it differs from that species in many characters as outlined above.

***Conservation status*:** This species has a broad, relatively undisturbed range but remains infrequently collected due to its remote habitat and wet-season phenology. A status of **Least Concern** is recommended (IUCN 2001).

***Etymology*:** The species is named for W.R. (Bill) Barker who has worked on Australian *Lindernia* for over 30 years.

Fig. 18. ***Lindernia barkeri***. Face view of flower, *c.* ×6 (*Barrett 1113*, PERTH). Photo: M. Barrett.

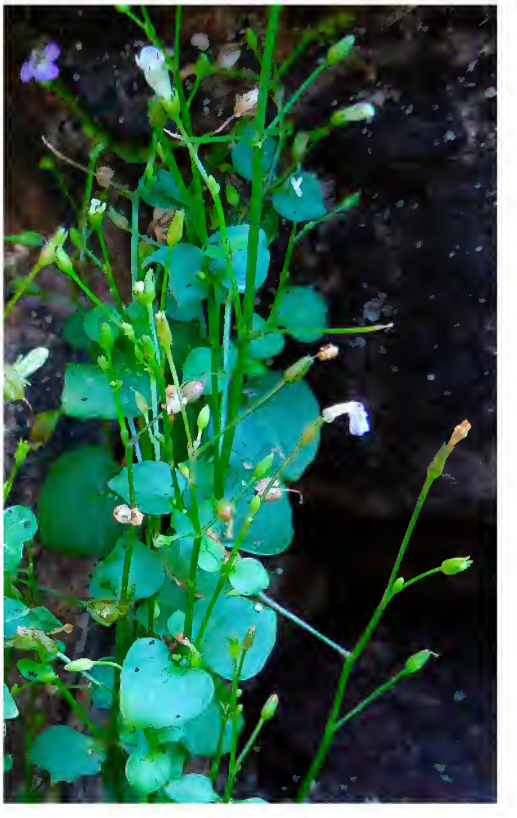

Fig. 19. ***Lindernia barkeri***. Habit with flowers, *c.* ×1 (*Wannan 6687 et al.*, CNS). Photo: B.S. Wannan.

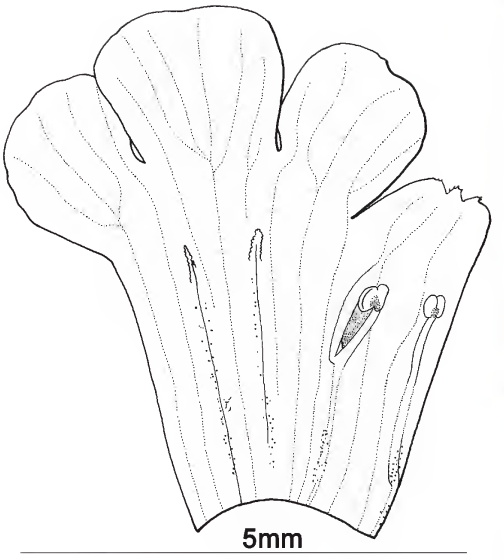

Fig. 20. *Lindernia barkeri*. Corolla opened to show stamens (*Wannan 2476*, CNS). Del. W. Smith.

Fig. 21. *Lindernia barkeri*. Leaf, *c.* ×3 (*Wannan 6681 et al.*, CNS). Photo: B.S. Wannan.

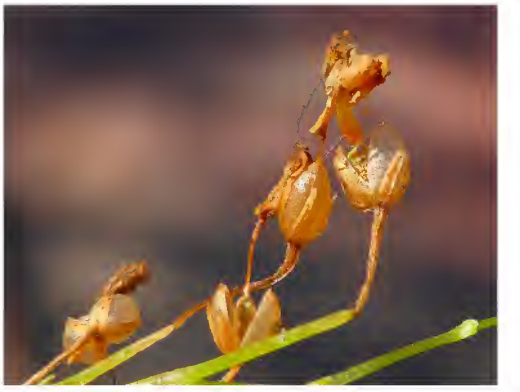

Fig. 22. *Lindernia barkeri*. Capsules, *c.* ×5 (*Wannan 6681 et al.*, CNS). Photo: B.S. Wannan.

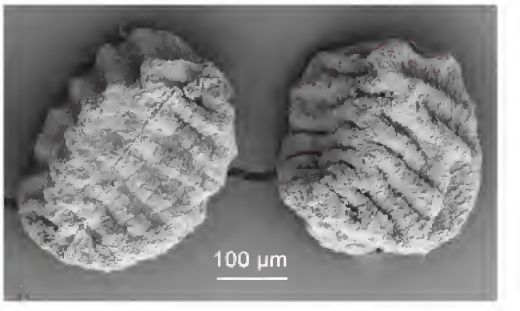

Fig. 23. *Lindernia barkeri*. SEM of seeds (*Wannan 2476*, CNS). Photo: Australian Museum.

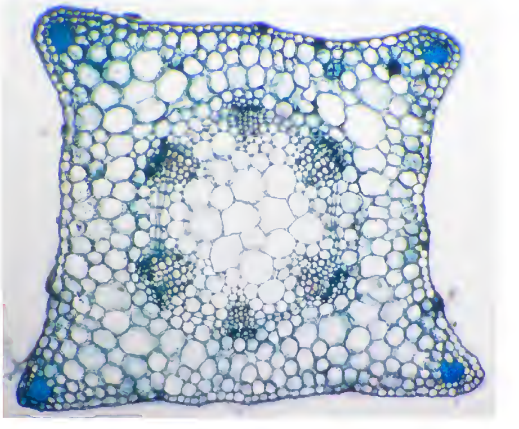

Fig. 24. *Lindernia barkeri*. Transverse stem section, *c.* ×70 (*Wannan 6687 et al.*, CNS). Photo: B.S. Wannan.

Fig. 25. Holotype of ***Lindernia barkeri*** (*Wannan 6687 et al.*, PERTH). Photo: F. Zich.

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Thanks to Darren Crayn (CNS) for his support of the project and the directors and staff of BM, BRI, CANB, CNS, DNA, MEL, NSW, PERTH and UNSW for loans and/or access to collections; Chris Quinn and the Australian Museum, Sydney for SEM of seeds; Matt Barrett (PERTH) who provided valuable comment and images, and Will Smith (BRI) for the floral illustrations and maps. This work has been supported by Australian Biological Resources Study (ABRS) National Taxonomy Research Grant Program CN211-26 which has been undertaken at the Australian Tropical Herbarium.

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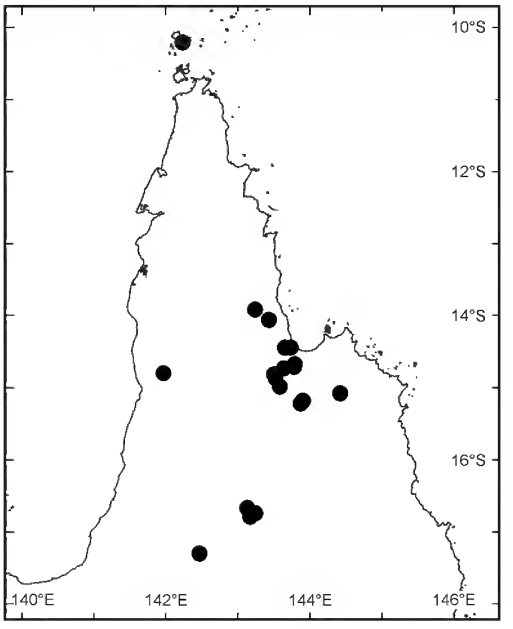
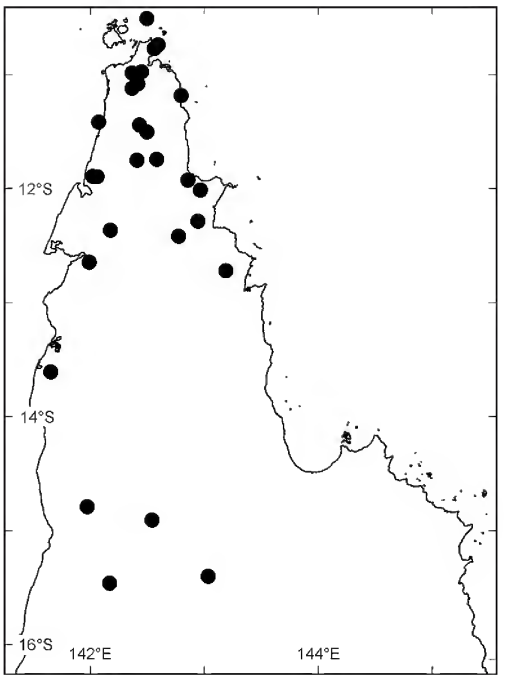
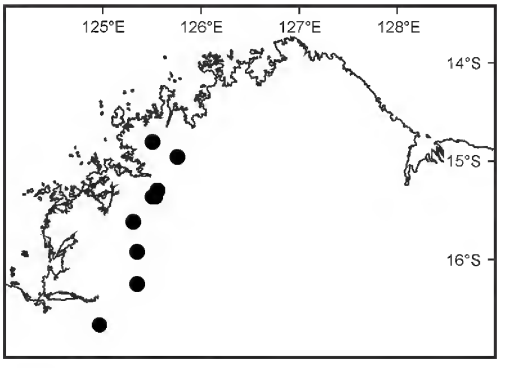


Map 1. Distribution of ***Lindernia stantonii***.



Map 2. Distribution of ***Lindernia beasleyi***.



Map 3. Distribution of ***Lindernia barkeri***.

Two new species of *Solanum* (Solanaceae) from the Northern Territory, Australia

A.R. Bean

Summary

Bean, A.R. (2016). Two new species of *Solanum* (Solanaceae) from the Northern Territory, Australia. ***Austrobaileya* 9(4): 524–533.** Two new species, *Solanum ultraspinosum* A.R.Bean and *S. apodophyllum* A.R.Bean are described and illustrated, and maps of their distribution provided. Both are related to *Solanum clarkiae* Symon. A key to the species comprising the *S. clarkiae* complex is provided.

Key Words: Solanaceae, *Solanum*, *Solanum apodophyllum*, *Solanum clarkiae*, *Solanum ultraspinosum*, Northern Territory flora, new species, taxonomy, distribution maps, identification key

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Introduction

The informal '*Solanum dioicum* species group' (Whalen 1984; Bean 2004) is confined to tropical Australia. The member species are characterised by either the dioecious habit (separate male and female plants), or the inflorescences strongly andromonoecious (a single hermaphrodite flower at the base of the cyme with numerous male flowers above it).

Martine *et al.* (2006) published a phylogenetic analysis of the *Solanum dioicum* species group based on data from the ITS gene region, and recovered five clades: Clade 1 comprising nearly all the dioecious species; Clade 2 comprising *S. heteropodium* Symon and *S. oedipus* Symon (both andromonoecious); Clade 3 comprising *S. beaugleholei* Symon, *S. chippendalei* Symon, *S. diversiflorum* F.Muell. and *S. phlomoides* A.Cunn. ex Benth. (all andromonoecious); Clade 4 comprising *S. clarkiae* Symon and *S. melanospermum* F.Muell. (both andromonoecious); and Clade 5 comprising two dioecious species from Kakadu National Park, *S. sejunctum* Brennan, Martine & Symon and *S. asymmetriphyllum* Specht. Martine *et al.* (2009) examined further gene regions, resulting in the same clades, but with improved resolution in some areas.

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Solanum clarkiae was described by Symon (1981), typified by a collection from near Oenpelli, in the Northern Territory, Australia. Morphologically, *S. clarkiae sens. lat.* has been recognised amongst its congeners by the non-clonal habit (Symon 1981; Brennan *et al.* 2006), the entire or shallowly lobed leaves lacking glandular hairs, the andromonoecious inflorescences, the relatively long styles, 13–20 mm long (Martine *et al.* 2009), the pedicel of the bisexual flower 2.5–4 cm long (Symon 1981), the calyx lobes attenuate, 2.5–5 cm long (Symon 1981, as 'linear'), the calyx tube not markedly accrescent at the fruiting stage (Symon 1981), and the calyx strongly recurved at the fruiting stage (Symon 1981). However, even within these constraints, specimens currently identified as *Solanum clarkiae* exhibit a range of morphological variation that is greater than that generally accepted for other *Solanum* species. Two groups of specimens stand out from the rest, and two new species are described here to accommodate these, viz. *S. ultraspinosum* and *S. apodophyllum*. These can be consistently distinguished from specimens of *S. clarkiae* by readily observable characters.

The species of the *Solanum clarkiae* complex are geographically separated from nearly all species in the *S. dioicum* group – the exceptions are two dioecious species, *S. sejunctum* and *S. asymmetriphyllum*. Quite

apart from their sexual expression, the species of the *S. clarkiae* complex are unlikely to be confused with these two species, which are tall plants (up to 2 m high), with very few prickles (if any) on the stems, and an accrescent calyx tube that encloses the mature fruit.

Materials and methods

This study is based on morphological examination of herbarium specimens from AD, BRI, CANB and DNA. Measurements are based on dried material, except for the corolla, anthers and style, where measurements were made from material reconstituted using boiling water.

The lobing index (used in the descriptions below) is the ratio between the length of the lobe halfway along the lamina and the parallel length at the adjacent sinus (see Bean 2004: 641, 642). The leaves of *Solanum* spp. are typically oblique, with one side of the lamina shorter than the other. The obliqueness index is a measure of how oblique the lamina base is (see Bean 2004: 641).

The distribution maps were compiled using DIVA-GIS Version 7.5.0, using geocodes given on the specimens seen by the author. An abbreviation in the specimen and locality citations is NP for National Park.

Taxonomy

Key to the species of the *Solanum clarkiae* complex

1 Leaves sessile; stellate hairs on upper leaf surface all with lateral rays ± at right angles to central ray (porrect) . . . . . **S. apodophyllum**

1. Leaves petiolate, petioles 10–33% of lamina length; stellate hairs on upper leaf surface mostly with ascending lateral rays, although some porrect **2**

2 Fruiting calyx with 2300–2700 prickles; male flowers with pedicels 3–11 mm long . . . . . **S. ultraspinosum**

2. Fruiting calyx with 190–310 prickles; male flowers with pedicels 11–16 mm long . . . . . **S. clarkiae**

Solanum apodophyllum A.R.Bean **sp. nov.** with affinity to *S. clarkiae*, but differing by the sessile leaves, the geminate sympodia, and the stellate hairs of the upper leaf surface all porrect. **Typus:** Northern Territory. About 2.5 miles [4 km] SW of Mount Gilruth, 28 February 1973, *M. Lazarides 7940* (holo: CANB; iso: DNA).

Sprawling or erect shrub, 0.6–1.2 m high. Sympodia difoliate, geminate. Branchlets brown, stellate hairy; prickles 16–32 per cm, straight and broad-based, 1–4.5 mm long, 5–7 times longer than wide, glabrous. Branchlet stellate hairs moderately dense, 0.3–0.8 mm diameter, stalks 0–0.2 mm long; lateral rays 4–7, porrect; central ray 0.2–0.5 times as long as laterals, not gland-tipped; short glandular hairs absent. Adult leaves elliptical or ovate, 7.3–15.5 cm long, 3–7.2 cm wide, 1.8–2.4 times longer than broad, entire, prickles absent; stellate hairs not gland-tipped, simple hairs absent; short glandular hairs absent; apex acute, base auriculate. Petioles absent. Upper leaf surface grey-green; stellate hairs distributed throughout, moderately dense to dense, 0.15–0.4 mm apart, 0.5–0.7 mm across, stalks 0–0.2 mm long; lateral rays 4–8, porrect; central ray 0.4–0.8 times as long as laterals. Lower leaf surface greenish-white; stellate hairs moderately dense to dense, 0.2–0.4 mm apart, 0.5–0.7 mm diameter, stalks 0–0.2 mm long; lateral rays 5–8, porrect; central ray 0.3–0.8 times as long as laterals. Inflorescence leaf-opposed, cymose (pseudo-racemose), common peduncle absent, rachis prickles present, with one bisexual flower at base of rachis, the rest male; flowers 5-merous, corolla rotate, purple, outer surface lacking prickles. Male flowers: inserted along rachis; rachis 40–90 mm long, bearing 6–10 male flowers; pedicels at anthesis 6–10 mm

long, prickles present; calyx tube at anthesis 1.5–2 mm long; calyx lobes attenuate, 6–9 mm long; calyx prickles 60–125, 1–3.5 mm long; stellate hairs moderately dense to dense, transparent, 0.4–0.7 mm across, stalks 0–0.2 mm long, lateral rays 4–6; central ray 0.3–0.7 times as long as laterals; corolla 10–14 mm long; anthers 8.7–9.2 mm long; filaments *c.* 0.5 mm long; ovary glabrous. Bisexual flower: inserted at base of rachis; pedicel 27–34 mm long; calyx prickles 615–785, 1–9 mm long; stellate hairs dense to very dense, transparent, 0.6–0.7 mm across, stalks 0–0.4 mm long, lateral rays 4–7; central ray 0.3–0.6 times as long as laterals; corolla, 20–23 mm long, style 17–18 mm long. Fruits solitary, globular, 20–25 mm diameter, white, calyx tube not accrescent; calyx lobes exceeding mature fruit, strongly recurved; calyx prickles 900–1100, 2–12 mm long; pedicels 38–43 mm long; seeds not seen. **Figs. 1, 2**.

***Additional specimens examined*: Northern Territory.** Near Mt Gilruth, Mar 1984, *Craven 8293 & Wightman* (CANB, DNA); Mt Gilruth area, Arnhem Land, Jun 1978, *Henshall 1875* (DNA).

***Distribution and habitat*:** *Solanum apodophyllum* is confined to the Mount Gilruth area of western Arnhem Land, Northern Territory (**Map 1**).

***Phenology*:** Flowers recorded in February and March; fruits in June.

***Notes*:** *Solanum apodophyllum* is unique among Australian *Solanum* species because of its consistently sessile leaves. All leaves on the available herbarium specimens are sessile and auriculate. In *S. heteropodium*, a species from the Kimberley region of Western Australia, the upper leaves are "sessile or shortly petiolate" (Symon 1981), but the lower leaves have well-developed petioles.

S. apodophyllum differs from *S. clarkiae* by the geminate sympodia, the shorter central ray of the branchlet stellate hairs, the sessile leaves, the absence of prickles from either leaf surface, the porrect stellate hairs on the upper leaf surface, the shorter pedicels on the male flowers, the greater number of prickles on the bisexual flower calyx and on the fruiting calyx, and the longer anthers.

***Conservation status*:** As *Solanum apodophyllum* is confined to rugged sandstone terrain in western Arnhem Land, it is not thought to be under any threat. Population sizes are unknown however, and if surveys revealed that the total population was small, then its conservation status would need to be reconsidered.

***Etymology*:** From the Greek *apodus* – without a foot, and *phyllon* – a leaf. This is in reference to the sessile leaves present in the species.

Solanum ultraspinosum A.R.Bean **sp. nov.** with affinity to *S. clarkiae*, but differing by the many more prickles on the calyx of the male flowers, the bisexual flower, and the fruiting calyx, and by the shorter pedicels of the male flowers. **Typus:** Northern Territory. About 17 km SE of Jabiru, Kakadu National Park, 29 March 1981, *L.A. Craven 6598* (holo: CANB [2 sheets]; iso: DNA).

Sprawling or erect shrub, 0.6–1.2 m high. Sympodia difoliate, geminate. Branchlets white, grey or brown, stellate hairy; prickles 90–136 per cm, straight and acicular, 1–6 mm long, 11–15 times longer than wide, glabrous or with a few stellate hairs at base. Branchlet stellate hairs sparse to moderate, 0.25–0.6 mm diameter, stalks 0–0.2 mm long; lateral rays 3–6, porrect or ascending; central ray 0.5–1 times as long as laterals, not gland-tipped; short glandular hairs absent. Adult leaves elliptical or ovate, 5.2–14 cm long, 2.3–7.2 cm wide, 1.6–2.3 times longer than broad, entire or shallowly lobed throughout, with 0 or 3 lobes on each side, lobes acute or obtuse, lobing index 1–1.3, stellate hairs not gland-tipped, simple hairs absent; short glandular hairs absent; apex acute, base cuneate, obtuse or cordate, oblique part 2.5–16 mm long, obliqueness index 10–13 percent. Petioles 0.6–2.3 cm long, 12–25% length of lamina, prickles present. Upper leaf surface green; prickles absent or 1–3 on midvein only, straight and acicular, 2–3 mm long; stellate hairs distributed throughout, moderately dense to dense, 0.25–0.5 mm apart, 0.4–0.6 mm across, stalks 0–0.05 mm long; lateral rays 4–8, porrect or ascending; central ray 0.7–1.2 times as long as laterals. Lower leaf surface greenish-white, prickles absent or

Fig. 1. Holotype of ***Solanum apodophyllum*** (CANB).

Fig. 2. Portion of the holotype of ***Solanum apodophyllum***, showing inflorescences.

1–10 on midvein only, straight, broad-based; stellate hairs moderately dense to dense, 0.2–0.35 mm apart, 0.5–0.8 mm diameter, stalks 0–0.15 mm long; lateral rays 7–8, porrect or ascending; central ray 0.5–0.9 times as long as laterals. Inflorescence supra-axillary, cymose (pseudo-racemose), common peduncle absent, rachis prickles present, with one bisexual flower at base of rachis, the rest male. Flowers 5-merous; corolla rotate, purple, inner surface glabrous, outer surface lacking prickles. Male flowers: inserted along rachis; rachis 52–88 mm long, bearing 10–15 male flowers; pedicels at anthesis 2.5–11 mm long, prickles present; calyx tube at anthesis 1–2 mm long; calyx lobes attenuate, 6–10 mm long; calyx prickles 450–600, 1–7 mm long; stellate hairs dense to very dense, transparent, 0.25–0.4 mm across, stalks 0–0.1 mm long, lateral rays 5–8; central ray 1–1.5 times as long as laterals; corolla 10–13 mm long, anthers 7–7.6 mm long, filaments *c.* 0.5 mm long; ovary with short glandular hairs. Bisexual flower: inserted at base of rachis; pedicels at anthesis *c.* 20 mm long; calyx tube *c.* 3 mm long; calyx lobes attenuate, *c.* 24 mm long; calyx prickles 1500–2000, 2–11 mm long; stellate hairs sparse to moderately dense, transparent, 0.3–0.4 mm across, stalks 0–0.1 mm long, lateral rays 3–5; central ray 1–2 times as long as laterals; corolla and style not seen. Fruit solitary, globular, 23–26 mm

diameter, white, calyx tube not accrescent; calyx lobes exceeding mature fruit, strongly recurved; calyx prickles 2300–2700, 5–14 mm long; pedicels 20–29 mm long; seeds black, 2.7–2.9 mm long. **Figs. 3, 4.**

***Additional specimens examined*: Northern Territory.** Little Nourlangie Rock, Apr 1980, *Dunlop 5427* (AD, CANB, DNA, NSW); Koongarra Jump Up area, Apr 1980, *Dunlop 5506* (AD, DNA); Kakadu NP, Mt Brockman, Mar 1995, *Egan 4569* (DNA); Kakadu NP, 10 km NE of Namarrgon, Mar 1995, *Russell-Smith & Lucas 10300* (DNA); Little Nourlangie Rock, Kakadu NP, Apr 1980, *Telford 7796 & Wrigley* (CANB); Little Nourlangie Rock, Kakadu NP, Apr 1980, *Telford 7807 & Wrigley* (CANB); 2.5 km NW of Koongarra Saddle, Kakadu NP, Apr 1980, *Telford 8116* (CANB).

***Distribution and habitat*:** *Solanum ultraspinosum* is confined to the Mt Brockman – Nourlangie Rock area of Kakadu National Park, Northern Territory (**Map 1**). It grows on sandstone slopes and plateaux, in sandy or skeletal soil.

***Phenology*:** Flowers and fruits have been collected in March and April.

***Notes*:** *Solanum ultraspinosum* is closely related to *S. clarkiae*, but differs by the geminate sympodia; the greater number of calyx prickles on the bisexual flowers, male flowers, and fruits; the shorter pedicels of the male flower; the mostly smaller stellate hairs on the calyx; and the ovary with short glandular hairs (glabrous for *S. clarkiae*). The number of prickles occurring on the fruiting calyx (2300–2700) is far in excess of that found on any other Australian *Solanum* species, and perhaps greater than any other *Solanum* species in the world.

***Conservation status*:** As *Solanum ultraspinosum* is confined to rugged sandstone terrain in Kakadu NP, it is not thought to be under any threat. Population sizes are unknown however, and if surveys revealed that the total population was small, then some formal conservation status would be appropriate.

***Etymology*:** From the Latin *ultra* – beyond, and *spinosa* – thorny or prickly. This epithet is given in reference to the extremely prickly fruiting calyx, which bears between 2300 and 2700 prickles.

Solanum clarkiae Symon, *J. Adelaide Bot. Gard.* 4: 277 (1981). **Type:** Northern Territory. 16 km SW of the East Alligator River crossing on the road to Oenpelli, 11 June 1967, *D.E. Symon 5156* (holo: CANB; iso: AD, B, K, NSW, NT, US).

***Illustrations*:** Symon (1981: 278, 279).

Sprawling or erect shrub, 0.5–1.5 m high. Sympodia difoliate, disjunct. Branchlets green, yellow, rusty or brown; stellate hairy; prickles 10–104 per cm, straight and acicular, 1–9 mm long, 6–16 times longer than wide, glabrous. Branchlet stellate hairs sparse to very dense, 0.25–0.8 mm diameter, stalks 0–0.5 mm long; lateral rays 4–8, porrect or ascending; central ray 0.5–2.0 times as long as laterals, not gland-tipped; short glandular hairs absent. Adult leaves ovate to broadly ovate, 4.1–15.5 cm long, 2.1–9 cm wide, 1.2–2.8 times longer than broad, entire or shallowly lobed throughout, with 3–4 lobes on each side, lobes acute or obtuse, lobing index 1–1.4; stellate hairs not gland-tipped, simple hairs absent; short glandular hairs absent; apex acute, base obtuse or cordate, oblique part 2–24 mm long, obliqueness index 3–16 percent. Petioles 0.7–3.5 cm long, 10–33% length of lamina, prickles present. Upper leaf surface green, yellowish or grey; prickles 0–11, absent or present on midvein only, or present on midvein and lateral veins, straight and acicular, 1–7 mm long; stellate hairs distributed throughout, sparse to very dense, 0.05–0.8 mm apart, 0.4–1.2 mm across, stalks 0–0.2 mm long; lateral rays 4–10, ascending or rarely 2-tiered; central ray 0.6–1.3 times as long as laterals. Lower leaf surface green to yellowish or rusty, prickles 0–14, absent or present on midvein only, or on midvein and lateral veins, straight and acicular or broad-based; stellate hairs sparse to very dense, 0.05–0.6 mm apart, 0.5–1.2 mm diameter, stalks 0–0.4 mm long; lateral rays 5–10, ascending or rarely 2-tiered; central ray 0.5–1.4 times as long as laterals. Inflorescence leaf-opposed or supra-axillary, cymose (pseudo-racemose), common peduncle absent, rachis prickles present, with one bisexual flower at base of rachis, the rest male; flowers 5-merous, corolla rotate,

Fig. 3. Fruiting calyces of ***Solanum ultraspinosum*** (*Egan 4569*, DNA).

Fig. 4. Plant of ***Solanum ultraspinosum*** (*Telford 8116*, CANB). Photo: I. Telford.

purple, inner surface glabrous, outer surface lacking prickles. Male flowers: inserted along rachis, rachis 20–280 mm long, bearing 9–23 flowers; pedicels at anthesis 11–16 mm long, prickles present; calyx tube at anthesis 1.5–2.5 mm long; calyx lobes attenuate, 4.5–8 mm long; calyx prickles 50–110, 1.5–4.5 mm long; stellate hairs moderately dense to very dense, yellow or transparent, 0.35–0.8 mm across, stalks 0–1.1 mm long, lateral rays 5–8; central ray 0.8–1.8 times as long as laterals; corolla 10–13 mm long, inner surface glabrous or with a patch of simple hairs at each lobe apex; anthers 6.5–7.5 mm long; filaments 0.5–1 mm long; ovary glabrous. Bisexual flower: inserted at base of rachis; pedicels at anthesis 16–26 mm long; calyx prickles 180–250, 1.5–10 mm long; stellate hairs dense, transparent to yellow, 0.4–0.9 mm across, stalks 0–0.9 mm long, lateral rays 4–8; central ray 0.7–1.3 times as long as laterals; corolla 13–21 mm long, inner surface glabrous; style 13–16 mm long, glabrous; ovary glabrous. Fruits solitary, globular, 17–28 mm diameter, white at maturity, calyx tube not accrescent; calyx lobes exceeding mature fruit, strongly recurved; prickles 190–310, 1.5–12 mm long; pedicels 25–40 mm long; seeds black, 2.7–3 mm long.

***Additional selected specimens examined*: Northern Territory.** Marchinbar Island South, Hopeful Bay, Sep 1994, *Brennan 2913* (DNA); Near UDP Falls, South Alligator, Feb 1969, *Byrnes 1389* (AD, CANB, DNA); Birdie Creek, Kakadu NP, Apr 1990, *Cowie 1102 & Leach* (DNA, MEL, NSW); Magela Creek upper catchment, Arnhem Land, Apr 1995, *Cowie 5720* (DNA); E of Mann River, *c.* 64 km SSW of Maningrida, Arnhem Land, Mar 2000, *Cowie 8695* (DNA); Mt Bundey, Mary River NP, Dec 2010, *Cowie 12854 & Stuckey* (B *n.v.*, DNA); Between Kambolgie Creek and Plum Tree Creek, Kakadu Stage 3, Apr 1993, *Egan 2134* (DNA); Wessel Islands, Oct 1972, *Latz 3397* (BRI, CANB, DNA); Elcho Island, Jul 1975, *Latz NEAR 6259* (AD); Mt Bundey, Feb 1989, *Leach 2093 & Dunlop* (DNA); NW Cotton Island, Aug 1996, *Mangion 251* (DNA); Vicinity of El Sharana Mining camp, Jan 1973, *Martensz & Schodde AE389* (AD, CANB, DNA); Dharrway Swamp, Elcho Island, Jun 2004, *A.A. Mitchell 7784* (AD, CANB, DNA); W side of Raragala Island, Wessel Island group, Nov 2006, *A.A. Mitchell 8665* (AD, DNA); 14 km S of Cannon Hill, Kakadu NP, Jan 1984, *Russell-Smith 915* (DNA); Northern Outlier, Kakadu NP, Mar 1995, *Russell-Smith 9894* (DNA); 12 km NE of Jabiru airfield, Kakadu NP, Mar 1995, *Russell-Smith & Lucas 10012* (DNA); 12 miles [19 km] W of the East Alligator River crossing on the road to Oenpelli, Jun 1971, *Symon 7179* (AD, DNA, CANB); On road to Oenpelli from Pine Creek, some km from East Alligator River crossing, Jun 1975, *Symon 10347* (AD); 10 km SW of Oenpelli Aboriginal Settlement, May 1988, *Weber 9910* (AD, DNA); Katherine River, Nibuldakya, Jul 1997, *Wightman 7014* (DNA).

***Distribution and habitat*:** *Solanum clarkiae* is widely distributed across the Top End of Northern Territory, from Mt Bundey to the Wessel Islands, but mainly in Kakadu NP and western Arnhem Land (**Map 2**). It usually grows among sandstone boulders, or on sandy soils adjacent to sandstone outcrops, but is also recorded from a granite outcrop (Mt Bundey), and on swamp margins (Elcho Island).

***Phenology*:** Flowers are recorded from September to May; fruits are recorded from March to November.

***Notes*:** Apart from the two species described herein, *Solanum clarkiae* is most closely related to *S. melanospermum*. *S. clarkiae* differs by the shallowly lobed adult leaves (deeply lobed for *S. melanospermum*), the pedicels with stellate hairs throughout (glabrous at distal end for *S. melanospermum*), the greater number of calyx prickles on both the male and bisexual flowers, and the calyx prickles glabrous or with hairs at the very base of the prickle (hairs attached throughout most of the length of the prickle in *S. melanospermum*).

Solanum clarkiae is a variable species, notwithstanding the removal of *S. ultraspinosum* and *S. apodophyllum*.

Specimens from near the type locality have dense to very dense indumentum on the leaves, the number of male flowers is typically 9–13, and the rachis length is between 50–80 mm. Specimens from the more southerly parts of Kakadu NP have narrower sparsely hairy leaves and long petioles, with up to 23 male flowers on a rachis up to 280 mm long; specimens from Mt Bundey have sparsely hairy leaves with very short petioles. It is therefore possible that further taxa exist, but additional collections and field observations would be needed to determine the significance of the observed differences.

***Conservation status*: Least Concern**. The distribution of *Solanum clarkiae* is extensive, and much of it is in Kakadu NP and adjacent parts of Arnhem Land. There would appear to be no significant threats to its future survival.

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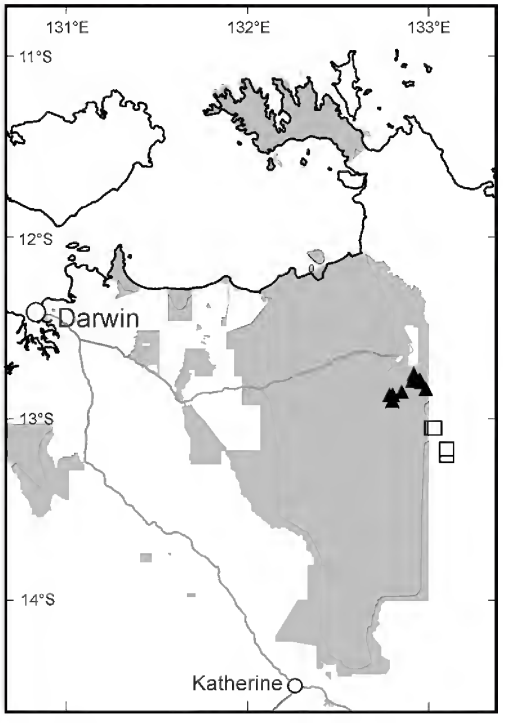
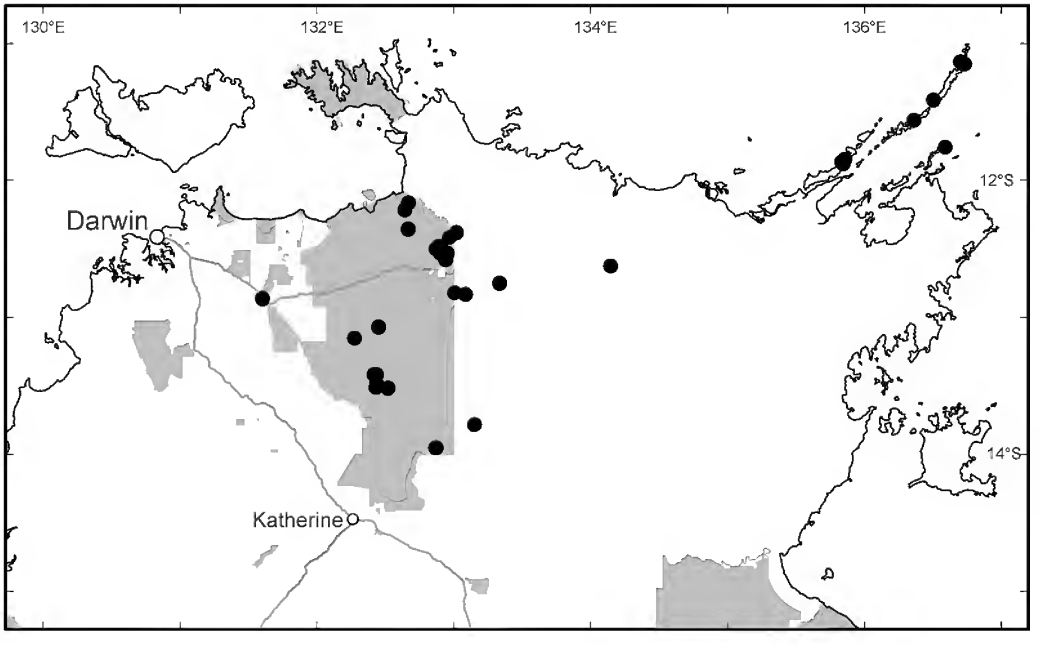


Map 1. Distribution of ***Solanum apodophyllum*** □ and ***S. ultraspinosum*** ▲ in the Northern Territory.



Map 2. Distribution of ***Solanum clarkiae*** in the Northern Territory.

Mallotus pleiogynus Pax & K.Hoffm. (Euphorbiaceae), a new species record and range extension for Australia from Cape York Peninsula, Queensland

Paul I. Forster

Summary

Forster, P.I. (2016). *Mallotus pleiogynus* Pax & K.Hoffm. (Euphorbiaceae), a new species record and range extension for Australia from Cape York Peninsula, Queensland. ***Austrobaileya* 9(4): 534–538.** *Mallotus pleiogynus* is confirmed from five locations on Cape York Peninsula, Queensland, and represents a new species record for both Australia and Queensland. Notes for this species are provided in relation to its distribution and habitat, key characters to distinguish it from similar species, and conservation status. The occurrence of *M. pleiogynus* in Australia can be considered as peripheral to the main distribution elsewhere on New Guinea. The importance of peripheral populations for otherwise widespread species is briefly reviewed; however, it is concluded that the Australian populations of this species should be classified as Least Concern.

Key Words: Euphorbiaceae, *Mallotus*, *Mallotus discolor*, *Mallotus nesophilus*, *Mallotus pleiogynus*, Australia flora, Queensland flora, New Guinea flora

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Introduction

The genus *Mallotus* Lour. was last revised for Australia nearly 20 years ago wherein 13 species were recognised as native (Forster 1999). *M. pleiogynus* Pax & K.Hoffm., otherwise previously recorded from the island of New Guinea, is documented here as a new species record and range extension for Queensland and Australia.

In June 1995 and June 1996 botanical exploration, mainly for vascular plants occurring in rainforest communities, was undertaken in the southern McIlwraith Range on Cape York Peninsula, specifically in the area of Station Creek and the access tracks to the abandoned Klondyke ('Klondike' by some collectors) mine. In addition to herbarium collections, some live material of diverse plants were also collected on these occasions and subsequently cultivated.

One such collection of a *Mallotus*, that was encountered in a sterile state at the time, has subsequently been flowered in cultivation (**Figs. 1 & 2**) enabling its identification as *M. pleiogynus*, a moderately to large sized tree that can grow up to 30 m high. This species is superficially similar to both *M. discolor* F.Muell. ex Benth. and *M. nesophilus* Müll. Arg. that are widespread and endemic to Australia (Forster 1999) and a critical examination of holdings of these species at BRI has enabled identification of several other collections of *M. pleiogynus* from Cape York Peninsula. This species is otherwise widespread on the island of New Guinea, both in Indonesia and Papua New Guinea (Kulju *et al.* 2007). Together with *M. chromocarpus* Airy Shaw from New Guinea, these four species form a strongly supported clade, albeit with weaker interspecific relationships, based upon molecular analyses (Kulju *et al.* 2007; Sierra *et al.* 2010; van Welzen *et al.* 2014). The veracity of this clade is supported by the shared morphological features of "stipules absent, anther connectives conspicuously broadened (umbrella-like) and fruits indehiscent" (Kulju *et al.* 2007).

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Fig. 1. ***Mallotus pleiogynus***. Flowering branchlet (*Tucker MCT6037c*, BRI). Photo: G. Leiper.

Fig. 2. ***Mallotus pleiogynus***. Racemes of male flowers (*Tucker MCT6037c*, BRI). Photo: G. Leiper.

Taxonomy

Mallotus pleiogynus Pax & K.Hoffm., *Das Pflanzenr.* IV,147: 187 (1914); *Octospermum pleiogynum* (Pax & K.Hoffm.) Airy Shaw, *Kew Bull.* 19: 312 (1965). **Type:** Papua New Guinea ["Kaiser-Wilhelmsland"]. Augusta Station, *[U.M.] Hollrung 782* (holo: B†; iso: K).

***Illustrations*:** Airy Shaw (1974: t. 3716); Kulju *et al.* (2007: 129).

Refer to Kulju *et al.* (2007) for a comprehensive description (also available online). As yet, the Australian collections are sterile or only have male flowers available.

Additional specimens examined. **Indonesia.** Papua: Andai, SW of Manokwari, Nov 1961, *Koster BW11915* (BRI); Warsamson Valley, E of Sorong, Aug 1961, *Schram BW12446* (BRI). **Papua New Guinea.** East Sepik Province: Near Melawei, Ambunti subdistrict, Jun 1966, *Hoogland 10348 & Craven* (BRI). Milne Bay Province: M.I. road to Mt Suckling, Rabaraba, Jun 1972, *Katik NGF46918* (BRI); Junction Ugat & Mayu Rivers, near Mayu Island, Jun 1972, *Streimann & Katik NGF28607* (BRI). Northern Province: near Budi Barracks, Tufi subdistrict, Aug 1954, *Hoogland 4522* (BRI). West Sepik Province: Aitape, Nov 1944, *McAnalan NGF526* (BRI). **Australia: Queensland.** Cook District: Haggerstone Island, May 1995, *Le Cussan 338* (BRI); 5.5 km WNW of Olive River mouth, 55.6 km NE of Moreton H.S., Bromley Holding, Jun 1994, *Fell DGF4460 & Buck* (BRI); Head of Swamp Creek, Table Range, 11.9 km SW of Lockhart River community, Lockhart River Aboriginal Reserve, Apr 1994, *Fell DGF4290 & Daunt* (BRI); Ex Rocky River Scrub, Silver Plains (cultivated at Cooroy), May 2016, *Tucker MCT14071* (BRI); Ex Klondyke, Station Creek track, McIlwraith Range (cultivated at Cooroy), Dec 2010, *Tucker MCT6037* (BRI); *ibid.*, Dec 2014, *Tucker MCT6037b* (BRI, CNS, MEL); *ibid.*, Mar 2016, *Tucker MCT6037c* (BRI, MEL).

***Distribution and habitat*:** In Australia, *Mallotus pleiogynus* is currently known from five localities on eastern Cape York Peninsula, Queensland. Outside of Australia it is widespread on the island of New Guinea both in Indonesian Papua and Papua New Guinea (Kulju *et al.* 2007). The Australian populations occur in semi-deciduous to evergreen notophyll vineforest on substrates derived from granite, lateritic or metamorphic rocks at altitudes between 20 and 420 m.

***Notes*:** In the identification key to Australian *Mallotus* (Forster 1999), material of *M. pleiogynus* will confound the character choices at couplet 7. By replacing couplet 7 with the following, material of this species can now be keyed out.

7. Lamina with interlateral (3°) veins poorly developed below (± obscured) . . . . **M. discolor**
Lamina with interlateral (3°) veins strongly developed below (clearly visible) **7a**

7a. Lamina with marginal extrafloral nectaries 6–10; stamens 50–60; fruit not longitudinally ribbed . . . . . **M. nesophilus**
Lamina with marginal extrafloral nectaries 9–20; stamens 15–50; fruit longitudinally ribbed . . . . . **M. pleiogynus**

***Conservation status*:** *Mallotus pleiogynus* joins the group of Euphorbiaceae species that are known in Queensland from a handful of populations but that are otherwise widespread in New Guinea or greater Malesia, namely: *Croton caudatus* Geiseler, *C. choristadenius* K.Schum. (Forster 2003), *Omphalea papuana* Pax & K.Hoffm., *Pimelodendron amboinicum* Hassk. and *Wetria australiensis* P.I.Forst. (Forster 1994; van Welzen 1998). Van Welzen *et al.* (2014) hypothesised that "*Mallotus* disperse well across water barriers as several contemporary species are very widespread". Cooper & Cooper (2004) note for *M. discolor* that "fruit [are] eaten by many bird species".

The isolated occurrences of this tree (and numerous others) in far north Queensland begs a number of questions, namely (1) are the populations relictual from a time when these habitats was more widespread in Australia and contiguous New Guinea (i.e. the land masses comprising the Sahul shelf (Crayn *et al.* 2015)?, or (2) are the populations an example of long range dispersal from other non-Australian parts of the species area of occurrence? It is widely recognised that considerable dispersal of plants occurred in the past when megathermal biomes were more widespread (Morley 2003) and landmasses were joined or much closer to one another

(Hall 2002). Many of these ancient dispersal events are now represented by relictual populations of taxa in small areas of suitable habitat. Given that *M. pleiogynus* is known from at least five localities, some of which are some distance from the sea, it is feasible that the species has been in Australia for some time with subsequent local dispersal.

The ancestral point of origin for *Mallotus* is hypothesised to be Borneo with dispersal to Africa in one direction and through Malesia to Australia in the other (van Welzen *et al.* 2014). These authors also present a dating analysis that places *M. pleiogynus* as putatively 'younger' than both *M. discolor* and *M. nesophilus*, thus supporting the hypothesis that the Australian populations are from subsequent dispersal events, rather than the result of an older lineage dispersal and speciation event as is the case with the other two species. Determination of whether the Australian populations are from single or multiple dispersal events from New Guinea can only be determined with further scientific study using molecular techniques.

Through evolutionary and spatial time, peripheral populations of widespread species have come and gone. They pose conceptual problems for jurisdictions when they occur in different political regions, particularly where conservation of natural systems may be valued in one area and not in others, and where conservation management is restricted to the level of species. Peripheral populations of widespread species are important for conservation if they show evidence of genetic divergence. "Peripheral populations are expected to diverge from central populations as a result of the interwoven effects of isolation, genetic drift, and natural selection....[and] are potentially important sites of future speciation events [disjunct speciation, *cf.* Levin 2000]. Conservation of peripheral populations may be beneficial to the protection of the evolutionary process and the environmental systems that are likely to generate future evolutionary diversity. Distinct traits found in peripheral populations may be crucial to the species, allowing adaptation in the face of environmental change" (Lesica & Allendorf 1995). Genetic differentiation is to be expected in peripheral populations as they are often in habitats that are dissimilar to those where the species is widespread. Conservation of genetically distinct populations also enhances capture of the range of genetic variation within a species (Millar & Libby 1991).

Peripheral populations (within a state or territory political context) of species that are otherwise widespread on the Australian continent are less significant in terms of conservation than those that are predominantly widespread outside of Australian jurisdiction and regulation control. This particularly applies to species that may be recorded as widespread in the Western Pacific or in Malesia (including New Guinea), yet are known from only a handful of populations in Australia and are markedly disjunct from where the species may be common. In this case *Mallotus pleiogynus* is disjunct by at least 350 km from other populations in New Guinea and it is perhaps unlikely that regular genetic exchange with those populations can occur. Hence, the restricted Australian populations of this species have high value for conservation (most are already within the National Park estate), not only in terms of their potential genetic divergence, but because they may represent the only sites where *in situ* conservation can be achieved.

Within the Australian context, *Mallotus pleiogynus* could be classified as **Vulnerable** or **Near Threatened** under a number of the IUCN (2001) criteria sets. To do so would be to ignore the low level of rainforest survey that has been undertaken on Cape York Peninsula, where large tracts of rainforest have never been examined by botanical collectors and in particular documentation of canopy trees is especially deficient. The five known localities for this species on Cape York Peninsula are not closely clustered; the widespread occurrence of these rainforest communities, together with an apparent non-specific substrate affinity, are all indications that the species may be found to be relatively common now that its identification has been resolved. It is also highly likely that

many collectors have dismissed plants of *M. pleiogynus* as being merely the abundant and widespread *M. nesophilus*. Unless clear threatening processes can be demonstrated, a conservation status of **Least Concern** is recommended for the Australian populations of *M. pleiogynus*.

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Observations on some tropical species of the lichen genus *Mycoblastus* Norman (Mycoblastaceae)

Gintaras Kantvilas

Abstract

Kantvilas, G. (2016). Observations on some tropical species of the lichen genus *Mycoblastus* Norman (Mycoblastaceae). ***Austrobaileya* 9(4): 539–545.** Three species of *Mycoblastus* from tropical latitudes are enumerated. Two are described as new: *M. oreotropicanus* Kantvilas from montane habitats in Papua New Guinea and *M. physodalicus* Kantvilas from Mt Bellenden Ker, Queensland, Australia. The nomenclatural complexities surrounding *M. dendrophorus* (Vain.) Zahlbr. from the Philippines are resolved, with a lectotype designated for this species, and its two forms, f. *hypomelaena* Vain. and f. *hypoleuca* Vain., reduced to synonymy. A key to the species of *Mycoblastus* recorded from the Southern Hemisphere is provided.

Key Words: Mycoblastaceae, *Mycoblastus*, *Mycoblastus dendrophorus*, *M. oreotropicanus*, *M. physodalicus*, lichenised fungi, new species, taxonomy, Australia lichen flora, Papua New Guinea lichen flora, Philippines lichen flora, Queensland lichen flora, identification key

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Introduction

The lichen genus *Mycoblastus* Norman is characterised by a crustose thallus containing a green coccoid photobiont, typically large, black or dark pigmented, immarginate apothecia, rich in colourful pigments, highly branched and anastomosing paraphyses that form a network around the asci, and lecanoralean asci that mostly contain one or two, relatively large, hyaline, usually simple ascospores (Kantvilas 2009; James & Watson 2009). Species of *Mycoblastus* typically occur on organic substrata such as humus-rich soil, wood or bark in cool, moist environments. The genus is more or less equally represented in both hemispheres, chiefly in temperate latitudes or at higher elevations in the tropics and subtropics.

The Southern Hemisphere species of the genus were revised by Kantvilas (2009) who treated eight species, chiefly from cool to cold temperate regions. That study suggested that there was some heterogeneity within the genus, with two groups supported by differences in thallus chemistry, ascus structure and ascospore morphology: the *Mycoblastus sanguinarius* (L.) Norman group, with single-spored *Mycoblastus*-type asci (after Hafellner 1984) and mostly containing atranorin, and the *M. dissimulans* (Nyl.) Zahlbr. group, with 2(–4)-spored asci approximating the *Biatora*-type and usually containing perlatolic acid (Kantvilas 2009). Subsequently Spribille *et al.* (2011a) demonstrated further heterogeneity within the *M. sanguinarioides* group using molecular methods, and erected a segregate genus *Violella* T.Sprib. for the Northern Hemisphere species, *M. fucatus* (Stirt.) Zahlbr. (Spribille *et al.* 2011b); the status of the *M. dissimulans* group was not investigated.

In the course of a revision of the genus *Mycoblastus* for the Southern Hemisphere (Kantvilas 2009), numerous additional specimens, including types from other regions were also studied (e.g. Kantvilas 2011). In this paper, three taxa from tropical latitudes are resolved. Including one unresolved taxon, this brings the number of species recorded for the Southern Hemisphere to eleven. A key to these species is provided.

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Material and methods

The study is based on specimens housed in the Natural History Museum, London (BM), collections from Papua New Guinea, kindly made available by Dr André Aptroot (ABL), and the collections of the author, housed in the Tasmanian Herbarium (HO). Observations of the thallus and apothecia are based on hand-cut sections mounted in water, 15% KOH (K) and 50% HNO_3 (N), and in Lugols Iodine (KI) and Lactophenol Cotton Blue after pretreatment with KOH. The description of ascus characters, apothecial pigments and ascospores follows Kantvilas (2009, 2011) where detailed accounts and illustrations of these features are provided. The two pigments observed are *fucatus*-violet (Kantvilas 2009) and *cinereorufa*-green (Meyer & Printzen 2000). Chemical analyses were undertaken by thin-layer chromatography using standard methods (Orange *et al.* 2001). For the new species, dimensions of ascospores are presented in the format, 5th percentile–*average*–95th percentile, with extreme outlying values in brackets; the number of observations is also given.

Taxonomy

1. Mycoblastus dendrophorus (Vain.) Zahlbr., *Catal. Lich. Univers.* 4: 3 (1926); *Lecidea dendrophora* Vain., *Ann. Acad. Sci. Fenn.,* Ser. A, 15: 139 (1921); *Lecidea dendrophora* f. *hypomelaena* Vain., *nom. inval.*, *Ann. Acad. Sci. Fenn.,* Ser. A, 15: 140 (1921); *Mycoblastus dendrophorus* f. *hypomelaenus* (Vain.) Zahlbr., *Catal. Lich. Univers.* 4: 3 (1926). **Type:** Philippines. Negros, vulcanus Canlaon, April 1910, *E.D. Merrill 6882* (lecto [here designated]: BM!).

Lecidea dendrophora f. *hypoleuca* Vain., *Ann. Acad. Sci. Fenn.,* Ser. A, 15: 140 (1921); *Mycoblastus dendrophorus* f. *hypoleucus* (Vain.) Zahlbr., *Catal. Lich. Univers.* 4: 3 (1926). **Type:** Philippines. Negros, vulcanus Canlaon, April 1910, *E.D. Merrill 6867* (iso: BM!).

Thallus pale greyish, composed of rather nodulose warts or granules 0.1–0.15 mm wide that soon become elongate, coralloid-isidioid and 0.5–0.8 mm tall, not sorediate, thinly scattered or in dispersed clusters over an effuse, very thin and patchy, blackish to dull bluish grey prothallus. **Apothecia** 0.3–0.8(–1) mm diameter, convex to subglobose, basally constricted, immarginate, dull or glossy black. **Proper exciple** in section 40–80 µm thick, hyaline to pale yellowish brown within, usually with bluish green, N+ crimson *cinereorufa*-green pigment in the outermost parts, becoming deflexed and ± excluded in older apothecia. **Hypothecium** hyaline to pale yellowish, ± intensifying yellowish or yellow-orange in KOH, densely inspersed with oil droplets. **Hymenium** densely inspersed with oil droplets, in the upper part intensely pigmented with a mixture of *cinereorufa*-green and *fucatus*-violet and appearing blue-black, K+ turquoise green, N+ crimson. **Asci** 2-spored, approximating the *Biatora*-type, with a well-developed, intensely amyloid tholus, pierced almost entirely by a conical, weakly amyloid masse axiale with a rounded apex. **Paraphyses** 1.5–2.5 µm thick, not capitate, highly branched and forming a complex reticulum, becoming rather lax in K. **Ascospores** ovate to ellipsoid, hyaline, persistently simple, 40–56 × 26–32 µm. **Chemistry:** atranorin; all spot tests negative or unreliable. **Fig.1A.**

***Typification*:** When Vainio (1921) described *Mycoblastus dendrophorus* (as *Lecidea dendrophora*) he perceived it had two forms, naming one f. *hypoleuca*, with well developed isidia and an indistinct prothallus, and the other f. *hypomelaena*, with a more verruculose thallus and blackish prothallus. Under the rules of nomenclature of the time, he was not required to erect a f. *dendrophora*; nor did he designate a type specimen for his species, *Lecidea dendrophora*. Having examined the type collections of both forms, I am convinced that just one taxon is involved, and the gradation from a nodulose granular thallus to one with more elongated granules that become coralloid-isidiate is evident in both collections. Nor is such morphology unusual in other species of *Mycoblastus*, as displayed, for example, by *M. oreotropicanus* (described below). Furthermore, the pigmentation of the apothecia and the thallus chemistry, critical characters in delimiting

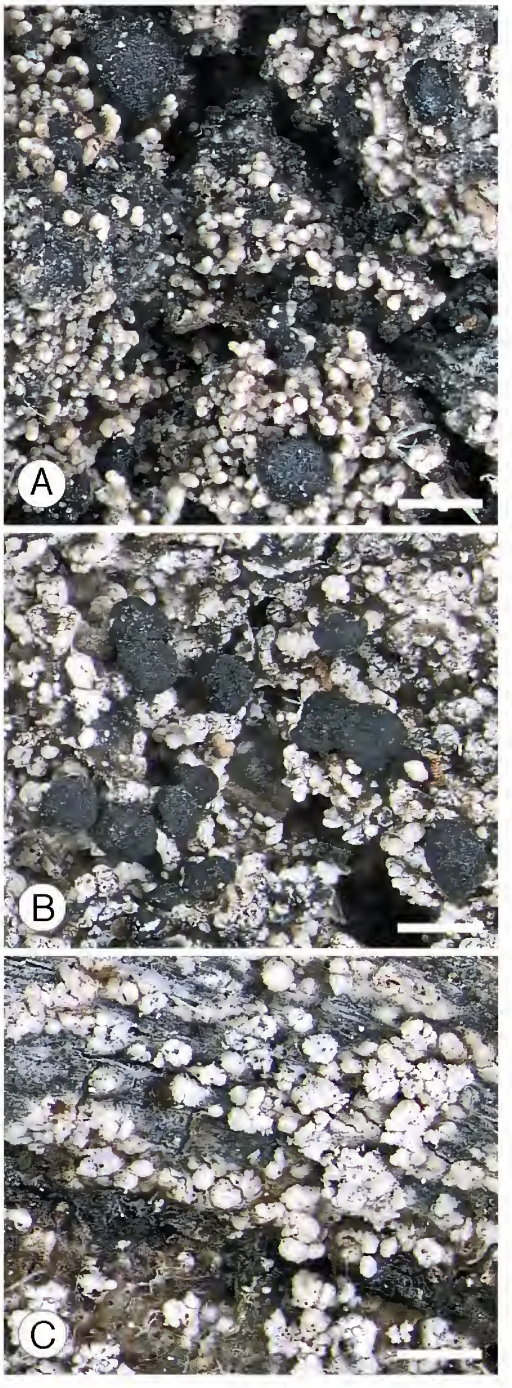

Fig. 1. ***Mycoblastus*** species, habit. A. ***M. dendrophorus*** lectotype, BM; B. ***M. oreotropicanus*** holotype, HO; C. ***M. physodalicus*** holotype, HO. Scale = 0.5 mm.

species of *Mycoblastus*, are the same in both. In uniting the two forms, the specimen of f. *hypomelaena* is selected as the lectotype, as it better displays the range of morphology of this species, from verruculose to elongated coralloid-isidioid, as well as having apothecia with better developed asci and ascospores. Thus both forms become synonyms under *M. dendrophorus*, and f. *hypomelaena* is deemed invalid (Art. 9.2, 9.11, 9.12 of the *Melbourne Code*).

***Notes*:** The material studied was in relatively poor condition, with few apothecia having an intact hymenium with well-developed asci and ascospores. Consequently it was not possible to make comprehensive observations of all characters, but the above description captures the salient features of the species. Critical features that characterise this species are the combination of a coralloid-isidioid thallus containing atranorin and the *Biatora*-type asci. The ascus type suggests a relationship between *M. dendrophorus* and the many, chiefly Southern Hemisphere species of the *M. dissimulans* group of Kantvilas (2009). However, the occurrence of atranorin is very unusual as most species of the group contain perlatolic acid.

2. Mycoblastus oreotropicanus Kantvilas **sp. nov.** *Mycoblasto bryophilo* Imshaug ex Kantvilas similis et item thallo granuloso vel verruculoso, acidum perlatolicum continenti et apotheciis pigmentum aeruginosum tinctis sed sorediis destitutis et ascosporis grandioribus, 50–100 µm longis, 24–60 µm latis differt. **Typus:** Papua New Guinea. Northern Province: Owen Stanley Range, Myola, *c.* 3 km NE of guesthouse, 9°08'S 147°47'E, 16 October 1995, *A. Aptroot 37645* (holo: HO).

Thallus whitish to pale cream, composed of scattered or crowded and contiguous, rather nodulose warts or granules 0.1–0.5 mm wide, not sorediate; prothallus not developed. **Apothecia** 0.4–1.2 mm diameter, convex to subglobose, basally constricted, immarginate, dull or glossy black. **Proper exciple** in section 40–100 µm thick, mostly hyaline within, usually with bluish green, N+ crimson *cinereorufa*-green pigment in

the outermost parts, becoming deflexed and ± excluded in older apothecia. **Hypothecium** 100–150 µm thick, hyaline to pale yellowish, ± intensifying yellowish in KOH, densely inspersed with oil droplets. **Hymenium** 110–200 µm thick, very densely inspersed with oil droplets, in the upper part intensely or dilutely pigmented with *cinereorufa*-green, K± olive-green, N+ crimson, rarely also with traces of *fucatus*-violet, K+ vivid turquoise green, N+ orange. **Asci** 120–170 × 45–60 µm, (1–)2(–4)-spored, approximating the *Biatora*-type, with a well-developed, intensely amyloid tholus, pierced almost entirely by a conical, weakly amyloid masse axiale with a rounded apex. **Paraphyses** 2–3 µm thick, not capitate, highly branched and forming a complex reticulum between and extending above the asci, remaining ± coherent in KOH, especially at the apices. **Ascospores** ovate to ellipsoid, hyaline, persistently simple, (50–)52–*69.4*–90(–100) × (24–)27–*38.2*–56(–60) µm; wall 5–8 µm thick. **Pycnidi**a not observed. **Chemistry:** perlatolic acid (major); all spot tests negative. **Fig. 1B.**

***Additional specimens examined*: Papua New Guinea, Simbu Province:** Mt Wilhelm, Pindaunde Valley, along track to summit, 5°47'S, 145°03'E, Aug 1992, *Aptroot 39544 p.p.* (ABL); *ibid*, Aug 1992, *Aptroot 33082 p.p.* (ABL); Mt Wilhelm, Pindaunde Valley near Lake Piunde, 5°47'S, 145°03'E, Aug 1992, *Aptroot 32647* (ABL); Mt Wilhelm, SE slope, 5°47'S, 145°03'E, Mar 1987, *Aptroot 18419* (ABL).

***Notes*:** *Mycoblastus oreotropicanus* is characterised by the combination of a granular-nodulose thallus containing perlatolic acid, the predominance of *cinereorufa*-green pigment in the apothecia and the relatively large ascospores. In some specimens the thallus becomes rather abraded but is never sorediate; in others the granules become somewhat elongate and almost coralloid, similar to what is seen in *M. dendrophorus*. The presence of perlatolic acid and the *Biatora*-type asci indicate that, within the genus *Mycoblastus*, the new species belongs to the *M. dissimulans* group. The most similar species in this group is *M. bryophilus*, which may also have a granular or nodulose thallus and apothecia dominated by *cinereorufa*-green but occasionally containing additional *fucatus*-violet pigment. However, *M. bryophilus* differs by being sorediate and by having smaller ascospores, 50–66 × 26–40 µm. Indeed the large ascospores of *M. oreotropicanus* distinguish it from all other esorediate, perlatolic acid only-containing species (*M. dissimulans, M. coniophorus* (Elix & A.W.Archer) Kantvilas & Elix, *M. kalioruber* Kantvilas) where no species has ascospores larger than 66 × 40 µm, and the average size is 43.1–49.5 × 24.2–28.1 µm (Kantvilas 2009). These species differ further in consistently containing fatty acids in addition to perlatolic acid. In analyses of *M. oreotropicanus*, traces of atranorin and other compounds were sometimes detected, but as these findings were not repeatable, they are considered to be due to contamination from associated lichen species.

***Distribution and habitat*:** *Mycoblastus oreophilus* is a lichen of subalpine (2700–4100 m altitude) scrub and alpine, treeless vegetation where it occurs on twigs of small shrubs, the bark of trees and on litter. All collections known so far are from Papua New Guinea.

***Etymology*:** The specific epithet alludes to the occurrence of this species in highland areas of the tropics (from the Greek prefix *oreo-*, meaning montane).

3. Mycoblastus physodalicus Kantvilas **sp. nov.** A *Mycoblasto disporo* (C.Knight) Kantvilas thallo disperse areolato, tandem papillato, sorediascenti differt. **Typus:** Australia. Queensland. Cook District: Mt Bellenden Ker summit area, ridge-line N of telecommunications facility, 20 October 2009, *G. Kantvilas 422/09* (holo: HO; iso: BRI).

Thallus crustose, whitish cream, comprised of irregular areoles, scattered or contiguous over an effuse, pale to dark blue grey prothallus; areoles becoming lumpy, 0.15–0.25 mm wide, developing isidia-like papillae that become abraded and coarsely sorediate; soredia whitish and concolorous with the thallus. **Apothecia** and **pycnidia** unknown. **Chemistry:** perlatolic and physodalic acid; thallus and soredia K–, KC–, C–, P+ orange-red, UV± whitish. **Fig. 1C.**

***Notes*:** Clearly it is not ideal to describe a new species without access to fertile material. However, in this case, more than six years have passed since this very distinctive taxon was first collected and studied, during which time several herbaria have been searched for additional collections without success. Physodalic acid is a rare metabolite in *Mycoblastus*, being known only from *M. disporus* (C.Knight) Kantvilas, a non-sorediate, austral species which likewise also contains perlatolic acid. Superficially, the new species is reminiscent of *M. campbellianus* (Nyl.) Zahlbr., although that species has a continuous, smooth thallus, discrete, speck-like or tuberculate soralia, and the P+ metabolite is virensic acid.

***Distribution and habitat*:** *Mycoblastus physodalicus* is known only from the type collection on the summit of Mt Bellenden Ker in the Wet Tropics of Queensland. The species was collected from fallen canopy limbs of *Dracophyllum sayeri* F.Muell. in low dense, scrubby forest dominated by *Leptospermum wooroonooran* F.M.Bailey at *c.* 1500 m altitude. Also present on this substratum were small thalli of additional, sterile *Mycoblastus* species which could not be determined.

***Etymology*:** The specific epithet refers to the occurrence of physodalic acid in this species.

Identification key to the Southern Hemisphere species of *Mycoblastus*

1 Thallus not sorediate **2**
1. Thallus sorediate **6**

2 Asci exclusively one-spored, with the ascospore ellipsoid to oblong, usually >60 µm long; apothecia frequently with small patches of reddish pigment beneath; thallus containing atranorin; Australia (Tasmania, Victoria), North America, north-eastern Asia . . . . . **M. sanguinarioides**
2. Asci usually at least two-spored, with ascospores ellipsoid to ovate, mostly <60 µm long (except to 100 µm in one taxon); red pigments not present beneath apothecia; thallus lacking atranorin but containing perlatolic acid **3**

3 Thallus P+ orange-red (containing physodalic acid in addition to perlatolic acid); Australia (Tasmania), New Zealand . . . . . **M. disporus**
3. Thallus P– (physodalic acid lacking) **4**

4 Thallus composed of scattered or contiguous nodulose warts or granules; ascospores 50–100 × 24–60 µm; containing perlatolic acid only; New Guinea . . . . . **M. oreotropicanus**
4. Thallus smooth to unevenly lumpy and verruculose, continuous; ascospores 35–70 × 18–40 µm **5**

5 Upper part of hymenium containing *cinereorufa*-green and/or *fucatus*-violet pigments; hypothecium colourless to pale yellow, usually K+ yellowish or yellow-orange; containing perlatolic acid ± fatty acids; Australia (Tasmania), New Zealand, southern South America, subantarctic islands, Chile (Juan Fernandez) . . . . . **M. dissimulans**
5. Upper part of hymenium with *cinereorufa*-green pigment only; hypothecium vivid yellow, K+ intense blood red; containing hybocarpone in addition to perlatolic and fatty acids; Australia (Tasmania, Victoria), New Zealand . . . . . **M. kalioruber**

6 Soredia P+ orange-red (containing physodalic, virensic or protocetraric acids, with or without perlatolic acid) **7**
6. Soredia P– (containing perlatolic acid without additional depsidones) **10**

7 Soredia confluent from the outset and forming a thick, granular crust; containing protocetraric and perlatolic acids); Australia (New South Wales, Victoria) . . . . . **M. leprarioides**
7. Soredia arising in discrete soralia that may become diffuse and confluent only in later stages of development. **8**

8 Soredia whitish to cream, ± concolorous with the thallus, arising from abrasion of scattered, isidia-like papillae; containing physodalic acid; Australia (Queensland) . . . . . **M. physodalicus**
8. Soredia whitish, paler than the usually dull leaden grey thallus, occurring in discrete, rather fleck-like soralia; thallus mostly smooth and continuous, containing virensic or protocetraric acids **9**

9 Containing virensic acid in addition to perlatolic acid; Australia (Tasmania, Victoria), New Zealand, southern South America, subantarctic islands . . . . . **M. campbellianus**
9. Containing protocetraric acid and lacking perlatolic acid; New Caledonia, Australia (Queensland) . . . . . **M. sp. cf. M. campbellianus**

10 Soredia ocurring in erumpent soralia; uncommon, typically growing on soil or turf; Australia (Tasmania), subantarctic islands . . . . . **M. bryophilus**
10. Soredia arising from cracks in the thallus and soon becoming scattered and confluent, sometimes forming a granular crust; very common and widespread, typically growing on bark or wood, more rarely on sheltered rocks; Australia (Tasmania, New South Wales, Victoria), New Zealand, southern South America; Chile (Juan Fernandez); subantarctic islands (including Macquarie Island) . . . . . **M. coniophorus**

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Frederick Hamilton Kenny (1859–1927), an Australian plant collector of note

A.R. Bean

Summary

Bean, A.R. (2016). Frederick Hamilton Kenny (1859–1927), an Australian plant collector of note. ***Austrobaileya* 9(4): 546–559.** A biography of Frederick Hamilton Kenny, a significant Australian plant collector in the early 20th century, is presented. Kenny was a medical doctor and surgeon, but also a keen amateur naturalist. He lived and worked in numerous towns during his life, and collected around 1170 botanical specimens between 1905 and 1924, mainly in Queensland and New South Wales, with his major collecting localities being Crows Nest, Gayndah, Gympie and Herberton in Queensland, and Glen Innes and Mosman in New South Wales. He served with the Australian Navy in World War I and his diary from this period gives an insight into his personality. He discovered a number of unknown plant species and four plant taxa were named for him. The number, provenance, presentation, significance and taxonomic diversity of his plant collections are discussed.

Key Words: Frederick Hamilton Kenny, historical botany, herbarium specimens, type specimens, handwriting, Australia flora, New South Wales flora, Queensland flora

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Introduction

Frederick Hamilton Kenny was one of numerous amateur naturalists and plant collectors that were encouraged by F.M. Bailey, Government Botanist in the late 19th century and early 20th century, to send plant specimens for identification and classification. Kenny was a medical doctor and surgeon, but for many years devoted his spare time to the study of natural history, and especially botany. No previous biographical information is available for Kenny. His name is not listed in any of the usual references where botanist's biographical notes are given e.g., Orchard (1999), Pearn (2001), George (2009), CHAH (2016). Nor is he mentioned in the *Australian Dictionary of Biography* (ADB 2006–2016). Despite this, his contribution to botany is significant and worthy of documentation.

Materials and methods

The Queensland Herbarium specimen database (Herbrecs) was used to generate a spreadsheet of Kenny's collections. The author has located many of these specimens, now scattered through the collection at BRI, to assess their quality, to check for the presence of original labels, and to add any information not recorded on the database. Details of specimens not at BRI were extracted from AVH (2016). The 'Trove' website (National Library of Australia 2009-onwards) has been extensively used, to uncover relevant articles published in newspapers of the time. A search of the Queensland Herbarium archives has uncovered a few relevant letters. Herbarium acronyms (e.g. BRI, MEL) follow Thiers (continuously updated).

Biographical detail

Frederick Hamilton Kenny was born at Banningham, Norfolk County, England, on 6th October 1859[1]. His father was Rev. Henry Torrens Kenny. He was one of nine children. One brother, A.L. Kenny, became an Anglican minister, and immigrated to Australia around 1900, living for many years in and around Rockhampton, Queensland[2].

Frederick received his Licence of the Society of Apothecaries (L.S.A.) in 1881, and

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qualified as a surgeon (M.C.R.S.) in London in 1882[3]. He arrived in Melbourne, Australia, on 28 January 1889, aboard the S.S. Hankow[4], and opened his own medical practice in Hawksburn, Melbourne, in November 1889, with his 'hours of consultation' given as 9–11am, 1–3pm and 6–8pm[5].

He married Alice Elizabeth Chomley at Warrnambool, Victoria on 25th February 1890[6]. A few years later they had a daughter, Mabel, who was born at Oakley in Melbourne, on 14th December 1894[7].

In 1896, Kenny sold his practice in Melbourne, and auctioned off his belongings – these included a "Hooded Speeding Buggy", a Gentleman's riding saddle, and an "upstanding chestnut horse" named Napoleon[8]. He moved across the continent to Coolgardie, Western Australia.[9] In July 1897, he signed on as the resident doctor at Nannine[10] in outback Western Australia. Nannine was at that time a thriving town that had come into existence because gold was found there, but it has long since been abandoned. Kenny evidently did not find Nannine to his liking because in February 1898 he left[11], and for a few months did locum work in Latrobe and Burnie in northern Tasmania[12]. He next went to north Queensland, arriving at Cairns by steamship[13] on the 30 August 1898, and made his way to Mareeba, where he set up practice[14]. This was a particularly short-lived venture, as he left Cairns again by steamship on 24 January 1899[15], and then spent some months in Sydney.

He commenced practice in Gympie, in south-eastern Queensland, in July 1899[17]. Kenny's eight-year stint living and working in Gympie (leaving in 1907) was the longest of his working life. This is not to say that he ceased to travel. Indeed he seems to have been an inveterate traveller – for instance, his name is listed as an attendee of an Intercolonial Medical Congress at Hobart in 1902[18].

At Gympie, he appears to finally make his mark on the world, and earns the respect and appreciation of the local community. At the Gympie General Hospital, Kenny made many improvements, including the addition of an X-ray machine and the paving of the operating theatre with white marble slabs. He was kept busy in the job, stating (in 1902) that "there are fewer mining accidents than one would expect on a gold field; but the timber-getters of the Blackall Range furnish many patients, and horse accidents are frequent"[19].

Fig. 1. Photograph of Frederick Hamilton Kenny, taken in February 1899[16].

He was appointed a Justice of the Peace in 1902[20], and subsequently he was sometimes called upon to pass sentence on people accused of minor offences at the Police Court in Nambour[21], and presumably also in Gympie. In 1906, he and his wife had a son, Rawdon, 12 years after the birth of Mabel (Morris 1991).

It is evidently during his time in Gympie that Kenny first became interested in botany. He maintained a correspondence with F.M. Bailey for about a decade that was beneficial to both men; Kenny received

plant identifications from Bailey, and Bailey learned of new plant taxa or distribution records through the collections of Kenny.

Twenty members of the Queensland Naturalists Club went to Gympie for an outing in early May 1907, and Kenny was actively involved in entertaining and guiding the participants. They also reportedly inspected Kenny's "fine collection of birds, plants, shells and minerals"[22].

Kenny became embroiled in a medical controversy after he amputated the leg of a boy, and the end result was that the Hospital Committee asked for his resignation in April 1907[23]. This was clearly distressing to Kenny and no doubt prompted his decision to get as far away from Gympie as possible. He resigned in June 1907, and travelled to Adelaide, spending some weeks there. Then in late July, he and his family boarded the S.S. Patroclus, bound for England[24], with Frederick employed as medical officer for the voyage[25]. Little is known about his time in the U.K., except that he undertook a course of medical study at the Edinburgh infirmary[26]. The family left England again in May 1908[27], and returned to settle at Mosman, a harbour-side suburb of Sydney, where Kenny collected numerous plant specimens. In November 1908, he was appointed as medical officer for the Lithgow zig-zag deviation railway construction, where 1200 men were working. He was based at the town of Clarence, and his salary was to be £800 per year[28], but within two months (January 1909), he was a resident of Hobart, Tasmania, and practicing medicine there! He stayed just long enough at Clarence to collect 28 plant specimens. There are numerous collections from the Hobart and Mt Wellington areas from 1909, but he spent less than a year there, and by November 1909, he was installed at Glen Innes, N.S.W.[29], where he lived until November 1911. During this period, he attended the Science Congress in Sydney[30], and in a letter published in the Sydney Morning Herald, he pronounced himself a botanist, and stated that he was acquainted with F.M. Bailey and his son[31].

From December 1911 to February 1912, he went on an extended holiday to north Queensland, collecting plant specimens from Cairns, Herberton, Kuranda, Lake Eacham, Mt Bellenden Ker, Harvey's Creek and Mourilyan. On his return, he attended a Field Naturalist Club meeting in Brisbane, and displayed some of his botanical specimens, including *Dracophyllum sayeri* F.Muell.[32]. This specimen is extant at BRI.

During the period February to July 1912, he travelled around the Darling Downs, perhaps working as a locum, as there are collections at BRI from Allora, Warwick and Pittsworth. On his travels on the Downs, he was clearly outraged at the ringbarking of trees on many road reserves, a measure taken in the belief that it would mitigate the spread of prickly pear (*Opuntia stricta* (Haw.) Haw.), which was rampant at that time. In an eloquent letter to the editor of The Brisbane Courier[33], Kenny denounced the ringbarking activities, suggested ways of combating the prickly pear scourge, and named some species of shade trees that could be used around homesteads and in towns, including *Celtis australis* L. and *Schinus molle* L.

Kenny started practicing medicine in Nambour in August 1912[34], but in October 1912 his place of residence was listed as Gayndah[35], and throughout 1913 he was employed at the Gayndah Hospital. However, he must have had a continued connection with Nambour, as he stitched a man's leg there in March 1913[36]. During his time at Gayndah, he wrote an informative article about the bird life of that town (Kenny 1915). In February 1914, he resigned from the position at Gayndah hospital[37], and returned to Glen Innes.

In August 1914, at the outbreak of World War I, Kenny volunteered for the Australian Navy, as the medical officer for the ship *Upolu*, and had his pay of £29 a month forwarded to his wife[38]. His ship and several others went to Rabaul in New Britain, which was previously under German control, then on to Fiji, anchoring in the harbour at Suva. The flotilla returned to Sydney in October 1914. None of the ships saw any action against German forces.

His next commission was aboard the *Fantome*, from early December 1914 to late February 1915. The flotilla patrolled the waters around New Britain and New Ireland, stationed at Rabaul, and also visited Kavieng. There was again no engagement with the German forces.

His diary included numerous references to trees and other flora growing at Rabaul and Fiji, and he stated a few times that he had "gathered some". Only a handful of these specimens survive at BRI, three from Rabaul and eight from Suva, about half of them non-indigenous species.

Commencing in March 1915, he was the staff surgeon of the HMAS Cerberus base at the Naval Depot, Williamstown, Victoria[39]. In August 1916, Kenny gave medical evidence regarding the accidental death of a seaman on one of the naval vessels, concluding that he died from "concussion of the brain"[40]. A letter published on 19 December 1916 showed that he was then still at HMAS Cerberus[41]. Later, it seems that he was stationed at a military camp in Victoria[42].

In April 1918, Kenny attended a Field Naturalists Club meeting in Brisbane, where he was officially welcomed back after his Navy attachment[43]. A few days later, he attended their outing to Ipswich[44].

He then returned to live in Glen Innes, although he visited Boggabri in September 1918 (Queensland Herbarium 2016). In January 1919, he purchased a practice at Crows Nest, near Toowoomba in Queensland, and moved there[45]. He had no sooner arrived at Crows Nest than he was inoculating people against the deadly influenza pandemic that killed millions of people in other parts of the world[46]. In September 1919, he was involved in an Ornithologist's conference held in Brisbane, which attracted delegates from throughout Australia. There was afterwards a trip to the Bunya Mountains[47].

His daughter Mabel was married at Glen Innes in March 1920. She had two sons, born in 1921 and 1922[48].

Kenny evidently paid a visit to Gympie in October 1921, as three of his specimens date from there (Queensland Herbarium 2016).

Kenny made many useful plant collections around Crows Nest, and turned up some interesting species. When C.T. White botanised the Crows Nest area in 1922, Kenny accompanied him (Williamson 1922), and no doubt showed him some of the most interesting places for flora. His last dated botanical specimen was collected in September 1924.

Kenny died at Crows Nest on the 5th May 1927, and he was buried in Toowoomba. It was reported that "heart trouble made him an invalid for the five or six months prior to his death".[49]

Discussion

Kenny evidently had wanderlust, for he lived and worked in many Australian towns and cities, rarely staying more than a year or two. His relatively high income as a doctor allowed him to do this, but I believe it was his insatiable appetite for knowledge and life experiences that were the main motivation for his many trips and changes of work location.

Kenny's wartime diary (covering the period August 1914 to February 1915) is a strange mixture of personal letters (addressed to his wife) and everyday happenings, but it gives a lively account of what was essentially a period of inactivity. The narrative indicates what life was like at that time, and also provides great insight into his personality and character.

Kenny was clearly an extrovert, and during his Navy service he spent a lot of time talking with his colleagues and other seamen, and met as many people as possible when on shore, and he appeared to be much-liked both by his peers and his naval superiors. He commented in his diary on one occasion that "for once I didn't talk", implying that this was a rare occurrence.

By his own admission, he was a very curious man, always keen to have new experiences and to see new things. He wrote "Wherever one goes one should first of all follow up your own game & see & learn all

you can – then those adnexa that be nearest – in my case – Natural History". His diary is full of observations of various plants that he saw at Rabaul and Suva, but he also talked about mammals, fishes and insects that he came across. He described himself as "an energetic medical man who wants to evolve his mind by experience & actual work", and his thirst for new experiences is shown by his entry: "I've my name down for any odd job anywhere or anyhow".

He mentions his "sense of cleanliness, punctuality & order", and elsewhere in his diary it is clear that he liked things to be clean, tidy and efficiently done. He was very careful about the health of the men under his care, and he was vigilant with regard to food poisoning. The refrigeration units on board the ships were primitive and unreliable, and Kenny frequently had cause to throw large quantities of meat and other food overboard for fear it was infected with bacteria. Despite this caution, there was an outbreak of Ptomaine poisoning after some of the men ate contaminated canned food. Kenny was himself one of the victims.

He was very critical of the over-consumption of alcohol by many of his colleagues. This is consistent with a report he had earlier written while stationed at Gympie Hospital, when he described alcohol as a "toxin", and stated that "I am strongly of opinion that all forms of alcohol should be refrained from"[50]. From his diary we learn that he himself was not a teetotaller, but drank alcohol only sparingly, and only after 7 pm. The diary also reveals that Kenny was a regular smoker of cigarettes.

He was an advocate of exercise for both the mind and body. One day he wrote "I went for a 7 mile walk on Saty aft [Saturday afternoon] – this keeps me fit & well & in addition I exercise my powers of observation which enables me to collect any new plants I come across". One of his maxims, impressed upon his children, was "Early bed, early rise – to each his or her duty & then play & pleasure".

Several letters from F.M. Bailey to Kenny are present in the Queensland Herbarium archives, but only one letter written by Kenny (dated 1st May 1913) is preserved. At this time, he was living at Gayndah, and in the letter, he expressed concern that *Lantana sellowiana* (now known as *L. montevidensis* (Spreng.) Briq.) was then becoming widely naturalised in the Gayndah district.

Kenny's surname

It is not obvious whether 'Hamilton' should be regarded as a part of a hyphenated surname, or whether it is a Christian name, perhaps commemorating an ancestor. Evidence in favour of the former includes his marriage notice in 1890 which is headed "Hamilton-Kenny–Chomley", and that his children were named "Mabel Hamilton Kenny" and "Rawdon Hamilton Kenny".

However, his father's name was Henry Torrens Kenny, and his brother's name A. Lee Kenny, with no mention of 'Hamilton'. Furthermore, Frederick was generally known to his contemporaries as Dr Kenny, and if this were incorrect, he surely would have apprised them. His wife's name was listed on the electoral role as "Alice Elizabeth Kenny"[51]. Also, Mabel's gravestone reads "Mabel Hamilton Bloxsome" – if her unmarried surname were Hamilton-Kenny, then her married name would have been just Mabel Bloxsome. On balance then, it seems that 'Kenny' alone is the surname, and 'Hamilton' was a cherished family name used by him and passed onto his children.

Handwriting

Kenny's handwriting is quite distinctive, with its upright script, many flowing curves contrasting with the long prominent cross-piece of the 't' (**Fig. 2**), and the often incomplete loops on 'y' and 'g'. Nevertheless, his writing is difficult to decipher. For example, he did not produce the upper loops on 'm' and 'n', and these letters appear as 'w' and 'u' respectively.

Specimens

Kenny made around 1170 botanical collections. The great majority of Kenny's

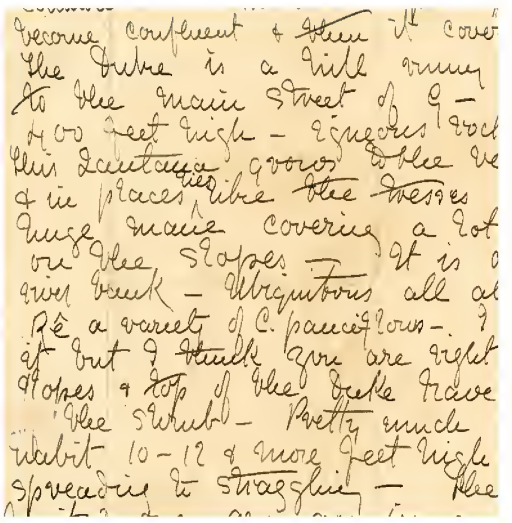

Fig. 2. A sample of the handwriting of F.H. Kenny[52]

specimens are at BRI, where there are a total of 1148 specimens. Of these, three were collected at Rabaul, eight at Suva, 12 from Victoria, 15 from South Australia, 38 from Tasmania, 269 from New South Wales, and the remainder from Queensland.

There are some Kenny specimens at other Australian herbaria (AVH 2016). There are five specimens at MEL, one of which is not at BRI. There are 26 specimens collected by Kenny at AD, all of the family Orchidaceae – these were undoubtedly sent to Adelaide because R.S. Rogers, a noted orchid expert was resident there. NSW has 32 specimens – most of these are duplicated from BRI, but a few are not present at BRI, including *Eucalyptus dura* L.A.S.Johnson & K.D.Hill and *Corymbia abergiana* (F.Muell.) K.D.Hill & L.A.S.Johnson (surely sent to J.H. Maiden, the eucalypt expert at that time) and *Stenochlaena palustris* (Burm.f.) Bedd. from Suva (probably sent to fern expert T. Whitelegge). One collection of *Tephrosia varians* (F.M.Bailey) C.T.White is at DNA (also present at BRI), although this is obviously a later duplicate distribution. There are at least three duplicates of Kenny's type specimens at K, which were sent from BRI by C.T. White.

Kenny's specimens are all vascular plants; there are no mosses, lichens or fungi. Within the flowering plants, he showed a strong bias towards the dicotyledons. Species from the families (specimen numbers indicated in brackets) Asteraceae (109), Fabaceae (104), Myrtaceae (80), Mimosaceae (66), Rutaceae (51), Ericaceae (39), Orchidaceae (36), Lamiaceae (33), Goodeniaceae (23), Rubiaceae (23) and Proteaceae (20) were the most frequently collected. It appears that he did not have an interest in grasses, as only 11 Poaceae specimens exist.

From the author's observation of hundreds of Kenny's specimens at BRI, it appears that he usually (perhaps always) sent his specimens attached with strips of opaque adhesive tape to A4-sized pages of the *British Medical Journal* or *The Lancet* (**Fig. 3**). Upon the margins of these pages he wrote his collecting notes; the locality, the volume and page number from Bailey's *The Queensland Flora*, sometimes the date, and other brief notes about the plant itself, including the flowering time. His specimens are always rather small, but well pressed and without mould. Kenny did not number his specimens, and his provision of a collection date was erratic – he variously provided the exact date, the month and year, the month only, the year only, or no date at all. In many cases, the A4 pages have been discarded by Bailey or whoever mounted the specimens, but sometimes Kenny's notes have been excised and the small strips of paper are glued to the herbarium sheet (**Figs. 4, 5, 6**). These strips of paper are mostly off-white or yellowish in colour, and the printed text sometimes visible on these strips confirms that they have come from the journal pages.

A label with a particularly brownish coloured paper (evidently from the margins of a magazine or journal, as typeface is sometimes visible) was used by Kenny in some (mainly Nambour) collections (**Fig. 7**)

A subset of these are dated 1912 – this has assisted in dating the Nambour and Caloundra specimens for which no year of collection was provided.

Fig. 3. Specimen of *Amperea xiphoclada* (BRI [AQ201299]) mounted by Kenny onto a page of the British Medical Journal.

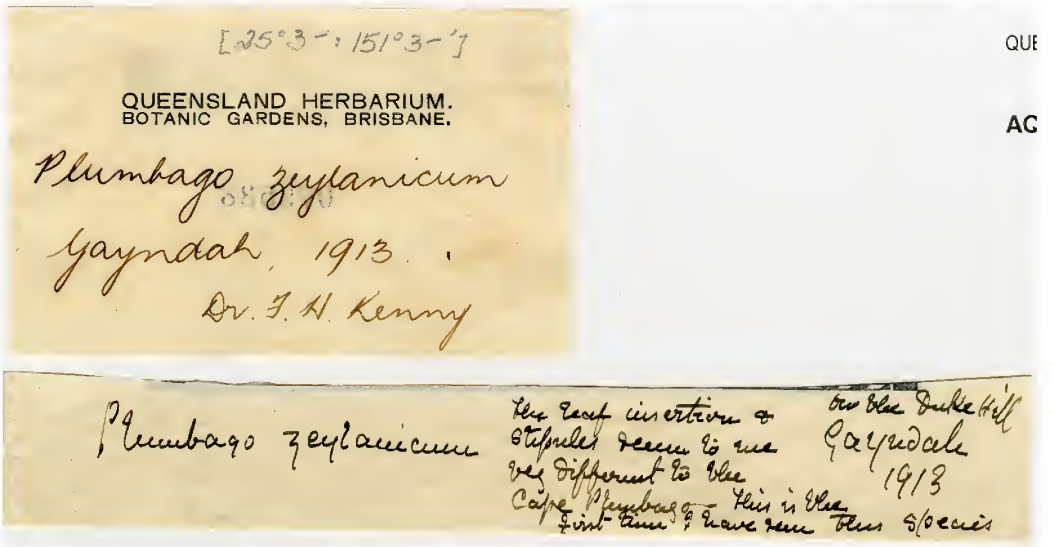

Fig. 4. Strip label with Kenny's notes (bottom) and herbarium label written by C.T. White (BRI [AQ79538]).

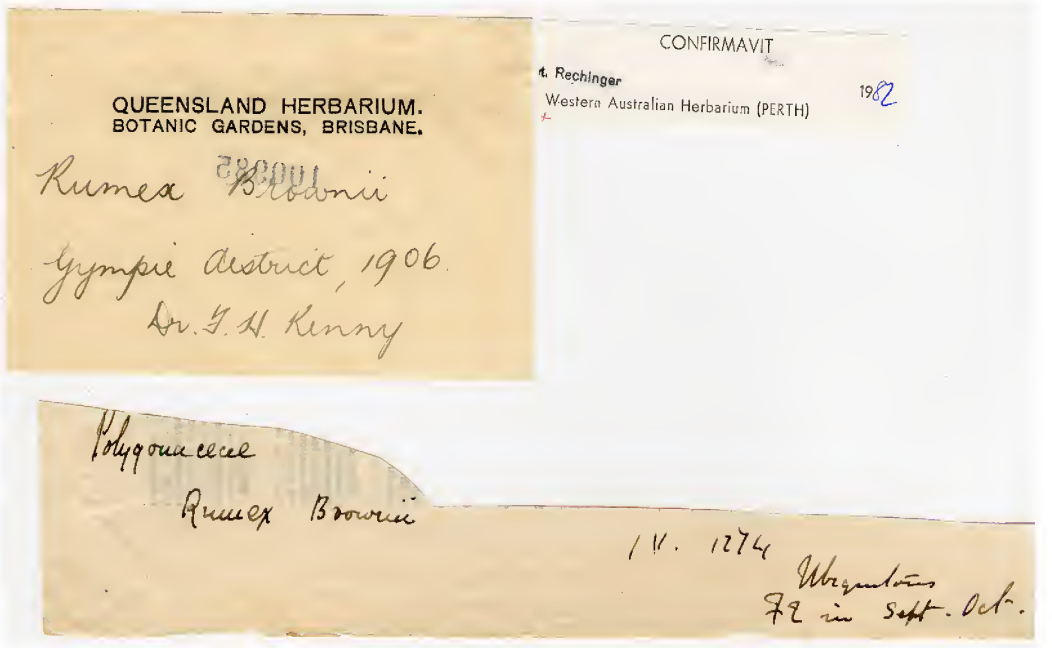

Fig. 5. Strip label with Kenny's notes (bottom) and herbarium label written by C.T. White (BRI [AQ100985]).

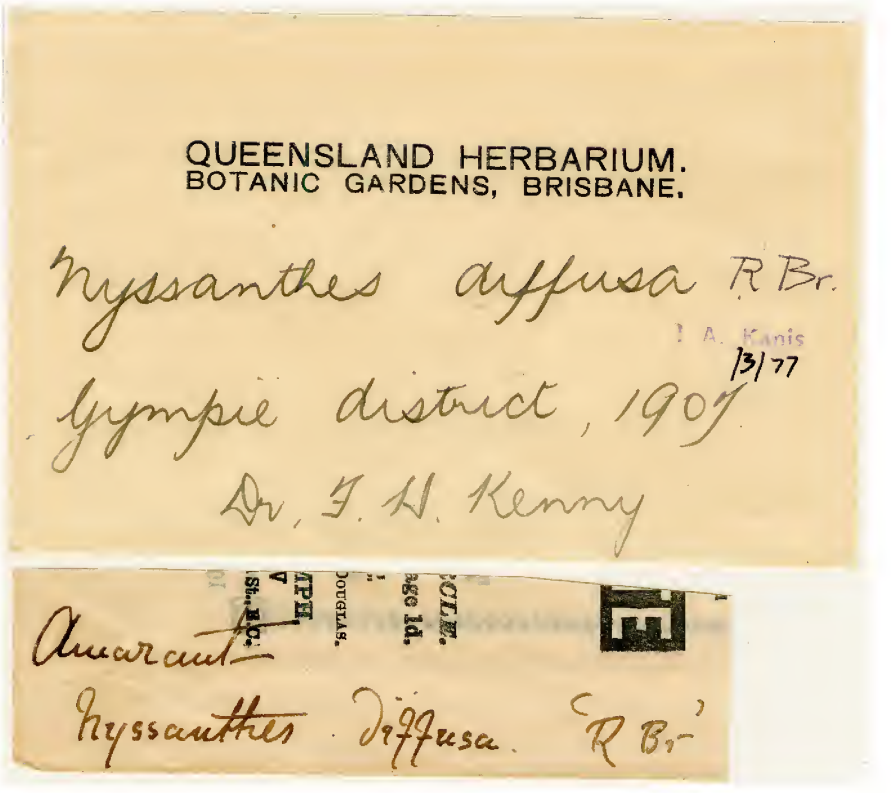

Fig. 6. Strip label with Kenny's notes (bottom) and herbarium label written by C.T. White (BRI [AQ169881]).

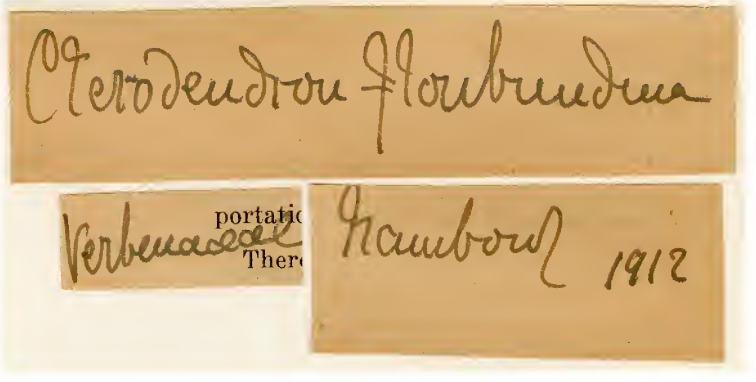

Fig. 7. A label with darker coloured paper that Kenny used in 1912 (BRI [AQ111406]).

Collecting localities

Kenny's major collecting localities were Gympie (324 specimens), Crows Nest (161), Herberton (125), Mosman (115), Glen Innes (98), Gayndah (61), Caloundra (52), Nambour (31), Clarence (28) and Mt Wellington (17).

The oldest specimen collected by Kenny for which the date can be confirmed is a specimen of *Callicarpa pedunculata* R.Br. from Gympie in March 1905. Between March 1905 and June 1907, he collected many specimens, of which over 300 are preserved at BRI – mainly from Gympie, but also from Nambour, Caloundra, Southport and Tweed Heads.

While at Gympie, Kenny was able to botanise only when he was not required at the hospital, so probably only on Sundays. He had a "dogcart"[53] (a light horse-drawn vehicle), and presumably used that to travel to various places around Gympie where interesting plants could be found. Unfortunately, the original labels for many of Kenny's specimens were not preserved, and for those only a written or typed label with the locality 'Gympie' is extant. However, where Kenny's labels are preserved, a good number of them give extra detail, and some of their localities are: Stumm Road, Scrubby Creek, Pie Creek, Deep Creek, Mary River scrubs, Wotton Hill, corner Wickham & Channon Streets, Ashford Hill. All of these locations are within 10 km of the Gympie Hospital, and most are considerably closer than that.

None of his Nambour collections gives any extra locality detail, except one which specifies 'Petrie Creek', the creek that runs through the middle of the town.

It seems that his Gayndah collections were similarly collected in close proximity to the town. Numerous specimens refer to 'Duke Hill', which is a hill a few hundred metres south of the main street of Gayndah, and the aquatic and riparian specimens were doubtless collected from the Burnett River running beside the town.

Botanical legacy and plant taxa named for him

As noted earlier, members of the Queensland Naturalists Club were shown Kenny's "fine collection of… plants…". This is confirmation that Kenny kept a personal herbarium, a collection of dried plant samples that he could refer to at any time. Towards the end of his time in Gympie, he wrote "I have personal knowledge and possession of over 800 species", referring to the flora of the area[54]. This suggests that his personal herbarium may have comprised 800 or more specimens. White (1927) stated that Kenny was one of the best amateur botanists in the state.

His collections from Gympie, Caloundra and Nambour in 1905 and 1906 are the oldest specimens at BRI from those towns, although it is possible that some of the specimens collected by F.M. Bailey in October 1874 and labelled 'Maroochie', are from around Nambour.

Kenny collected *Ricinocarpos speciosus* Muell.Arg. at Nambour, a species now listed as **Vulnerable** under Queensland legislation, which can no longer be found in the vicinity of that town due to land clearing and the invasion of woody weeds such as *Cinnamomum camphora* (L.) J.Presl and *Lantana camara* L. into its rainforest-fringe habitat. He also collected *Hemisteptia lyrata* (Bunge) Fisch. & C.A.Mey. at Nambour – this species is now extinct in coastal Queensland. His collection of *Asplenium wildii* F.M.Bailey is one of only two from south of Daintree. Kenny was the first to collect specimens of *Fontainea rostrata* Jessup & Guymer (**Fig. 8**) in 1906, a threatened species that is endemic to the Maryborough–Gympie area. He was the first to collect *Backhousia subargentea* (C.T.White) M.G.Harr. (from Pie Creek, near Gympie) in January 1907, and the first to collect *Agiortia pedicellata* (C.T.White) Quinn (from Caloundra) in August 1906.

Four taxa have been named for Kenny and in all cases his collections were used as the type: *Arthrostylis kennyi* F.M.Bailey, *Queensland Agric. J.* 28: 278, t. 58 (1912) = *Schoenus kennyi* (F.M.Bailey) S.T.Blake;

Fig. 8. ***Fontainea rostrata***, one of the species first collected by F.H. Kenny. Photo: G. Leiper.

Pultenaea kennyi H.B.Will., *Proc. Roy. Soc. Victoria* 35: 100 (1922) = *Pultenaea cuneata* Benth.; *Calanthe veratrifolia* var. *kennyi* F.M.Bailey, *Queensland Agric. J.* 28: 276, t. 57 (1912) = *Calanthe triplicata* (Willemet) Ames; and *Citriobatus pauciflorus* var. *kennyi* F.M.Bailey, *Queensland Agric. J.* 30: 402, t. 68 (1913) = *Pittosporum spinescens* (F.Muell.) L.Cayzer, Crisp & I.Telford.

Kenny collections were used as type material for *Centipeda racemosa* var. *lanata* F.M.Bailey (= *C. racemosa* (Hook.) F.Muell.), *Melastoma malabathricum* var. *nanum* F.M.Bailey (= *M. malabathricum* L. subsp. *malabathricum*), *Citriobatus multiflorus* var. *intermedius* F.M.Bailey (= *Pittosporum viscidum* L.Cayzer, Crisp & I.Telford), *Spermacoce jacobsonii* var. *glabrescens* F.M.Bailey (= *S. stenophylla* F.Muell.), *Zieria aspalathoides* var. *obovatum* C.T.White (= *Z. obovata* (C.T.White) J.A.Armstr.) and *Kunzea flavescens* C.T.White & W.D.Francis. Images of the type specimens for these names can be seen on the JSTOR Global Plants website (JSTOR 2016).

Acknowledgements

I gratefully acknowledge the "Trove" website provided by the National Library of Australia. All of the newspaper articles cited herein were located using this website. The State Records Authority of N.S.W. provided the photograph of Dr Kenny. Will Smith photographed the herbarium labels and the handwriting sample.

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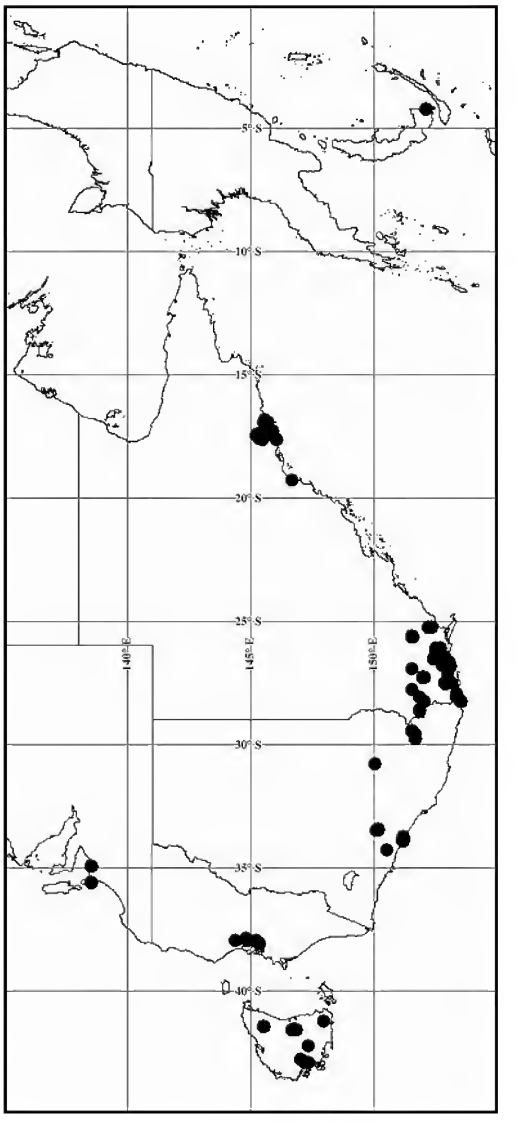

Map 1. The location of Kenny's plant collections (excluding Fiji).

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Taxonomic novelties in the *Solanum ferocissimum* group (Solanaceae: *Solanum* subg. *Leptostemonum*) from New Guinea

A.R. Bean

Summary

Bean, A.R. (2016). Taxonomic novelties in the *Solanum ferocissimum* group (Solanaceae: *Solanum* subg. *Leptostemonum*) from New Guinea, ***Austrobaileya* 9(4): 560–599.** Eleven *Solanum* species from the *Solanum ferocissimum* group are newly described for New Guinea: *S. arachnoides* A.R.Bean, *S. banzicum* A.R.Bean, *S. exemptum* A.R.Bean, *S. invictum* A.R.Bean, *S. malignum* A.R.Bean, *S. oomsis* A.R.Bean, *S. ortivum* A.R.Bean, *S. petilum* A.R.Bean, *S. phoberum* A.R.Bean, *S. pluriflorum* A.R.Bean and *S. scolophyllum* A.R.Bean. Five existing species are recircumscribed and newly described: *S. anfractum* Symon, *S. expedunculatum* Symon, *S. papuanum* Symon, *S. rivicola* Symon and *S. trichostylum* Merr. & L.M.Perry. *Solanum discolor* R.Br. and *S. fervens* A.R.Bean are newly recorded for New Guinea. Maps of the distribution of all these species based on herbarium specimens are provided, and the newly described species are illustrated. *S. turraeifolium* S.Moore and *S. yirrkalense* Symon are newly placed in synonymy with *S. discolor*. *S. galactites* A.R.Bean is a new name for *S. heteracanthum* Merr. & L.M.Perry. A key is provided to the 30 New Guinea species of the *Solanum ferocissimum* group.

Key Words: Solanaceae, *Solanum, Solanum* subg. *Leptostemonum*, *Solanum anfractum*, *Solanum arachnoides*, *Solanum banzicum*, *Solanum discolor*, *Solanum exemptum*, *Solanum expedunculatum*, *Solanum ferocissimum*, *Solanum fervens*, *Solanum galactites*, *Solanum invictum*, *Solanum malignum*, *Solanum oomsis*, *Solanum ortivum*, *Solanum papuanum*, *Solanum petilum*, *Solanum phoberum*, *Solanum pluriflorum*, *Solanum rivicola*, *Solanum scolophyllum*, *Solanum trichostylum*, new species, New Guinea flora, taxonomy, identification key, distribution maps

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Introduction

The island of New Guinea is one of the megadiverse areas of the world (Mittermeier *et al.* 1998), and includes one of the five global centres of plant diversity (Barthlott *et al.* 2007). Womersley (1978) stated that the flora of Papuasia "can be conservatively estimated as being in excess of 20000 species" of flowering plants. *Solanum* L. is one of many genera that are very well represented in New Guinea.

The taxonomic study of *Solanum* in New Guinea started only relatively recently. Scheffer (1876) described the first *Solanum* species with a New Guinea type (*Solanum incanum* Scheff.), from a collection made at Andai in West Papua, in September 1871 by Johannes Teijsmann.

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German botanists described several species before and after 1900, starting with Warburg (1891), and ending with the great solanologist Georg Bitter (Bitter 1917). The types of these, held at B, were subsequently destroyed during WWII. Duplicates of some type collections from Africa have been found (Vorontsova & Knapp 2010), but Symon (1985) listed ten New Guinea species names for which no type has been located.

Nine *Solanum* species were described by Merrill & Perry (1949) from New Guinea, all based on the collections of L.J. Brass. Four of these species are now classified under the genus *Lycianthes* Bitter.

Symon (1985) reviewed the entire genus for the island of New Guinea, including the species now included under *Lycianthes*. He described 19 new species, some of which he himself collected during two trips in 1977 and 1984.

Takeuchi (2001) described *Solanum symonianum* W.N.Takeuchi, from a collection that he made in the Morobe province of Papua New Guinea.

In a recent molecular study, Aubriot *et al.* (2016) included data from numerous New Guinea species, which produced some surprising clades that seem to contradict morphological groupings. This is especially so for the *Solanum papuanum* – *S. trichostylum* – *S. expedunculatum* group. Symon (1985) considered that these three "form a trio of closely related species", a view with which I concur. However, in the study of Aubriot *et al.* (2016), *S. papuanum* Symon and *S. trichostylum* Merr. & L.M.Perry are widely separated within the Sahul-Pacific clade, and *S. expedunculatum* Symon is far removed in a separate clade grouped with species that show no significant morphological affinity to it.

Because of this and other anomalies, I have preferred to define the *Solanum ferocissimum* group on morphological grounds, as defined by Whalen (1984) and corresponding to *S.* sect. *Graciliflora* used by Symon (1985). The *Solanum ferocissimum* group (*sensu* Whalen 1984) is characterised by the presence of stellate hairs, the presence of prickles (rarely absent), the cymose and often unbranched inflorescences, the usually deeply lobed 'stellate' corolla and the fleshy fruits that are (in most species) red at maturity. The group is distributed in Australia, New Guinea and Indonesia (Whalen 1984; Symon 1985).

From my examination of herbarium material belonging to this group, it became obvious that additional taxa are present in New Guinea. Some specimens grouped by Symon (1985) under one species name are markedly heterogeneous, and these have proved amenable to aggregation into smaller groups, forming more uniform and more readily diagnosable taxa.

Materials and methods

This account is based on a morphological examination of herbarium specimens from A, AD, BRI and CANB, 18 images of herbarium specimens held at NY (NYBG 2016), and 109 images of herbarium specimens held at L (Bioportal 2016). Images of type specimens from B, BM, F, K, MO and US have also been studied. All measurements were taken from dried herbarium material. Distribution maps were compiled using DIVA-GIS Version 7.5.0, from localities or geocodes given on the labels of specimens from the herbaria listed above.

Single gatherings that do not match existing taxa have been formally named only when there is good fertile material, and four or more characters separate it from its perceived nearest relative. There remain numerous other single gatherings from the *Solanum ferocissimum* group that do not readily align with any named species; these potential new taxa should await further collections. As a result of the new species described herein, the circumscriptions of *S. anfractum*, *S. expedunculatum*, *S. papuanum*, *S. rivicola* Symon and *S. trichostachyum* have been amended. Hence these species are redescribed in this paper. Species for which the circumscription is unchanged from Symon (1985) have not been described, although all 30 New Guinean species of the *S. ferocissimum* group are included in a dichotomous identification key. Species treatments are arranged in alphabetical order.

Notes on characters used

The density of the stellate hairs has been classified into five categories: very sparse (stellate hairs more than 2 diameters apart, centre to centre); sparse (stellate hairs between 1 and 2 diameters apart, centre to centre); moderately dense (stellate hairs between 0.5 and 1 diameters apart, centre to centre), and hence adjacent hairs overlapping; dense (stellate hairs between 0.1 and 0.5 diameters apart, centre to centre); and very dense (stellate hairs so numerous that the surface of the leaf is obscured at 40× magnification). The width of the prickles (used only in determining the length/width ratio) is measured at the very base of the prickle, when the base is easily seen; otherwise it is the point where the prickle surface is at 45 degrees to the leaf or branchlet surface. The common peduncle length is the distance from the subtending branchlet to the insertion of the lowermost

pedicel. The rachis length is the distance from the subtending branchlet to the insertion of the uppermost pedicel. Other terminology is detailed in Bean (2004).

Taxonomy

Key to the New Guinea species of the *Solanum ferocissimum* group

1 Branchlets with many simple multicellular glandular hairs 1–2 mm long (stellate hairs present or absent) **2**
1. Branchlets without simple multicellular glandular hairs **4**

2 Stellate hairs present on young vegetative growth . . . . . **27. S. saruwagedense**
2. Stellate hairs absent from vegetative parts of plant **3**

3 Flowering pedicel to 12 mm long; fruiting pedicel to 25 mm long . . . . **14. S. infuscatum**
3. Flowering pedicel 25–40 mm long; fruiting pedicel 60–80 mm long . . . **18. S. missimense**

4 Lower surface of fully expanded leaves glabrous, or with very sparse to sparse stellate hairs (hairs not overlapping) **5**
4. Lower surface of fully expanded leaves with moderately dense (hairs overlapping) to very dense stellate hairs **16**

5 Prickles absent from branchlets and leaves **6**
5. Prickles present on branchlets, and sometimes leaves **7**

6 Stellate hairs on lower leaf surface 0.5–0.7 (–1) mm diameter, with 4–8 filamentous lateral rays . . . . . **29. S. symonianum**
6. Stellate hairs on lower leaf surface 0.2–0.4 mm diameter, lateral rays 6–8, short and thick . . . . . **2. S. anfractum**

7 Branchlet prickles needle-like, 8–16 times longer than wide **8**
7. Branchlet prickles broad-based, 1–4 times longer than wide **9**

8 Fruits elliptic with a rostrate apex; leaf prickles absent or on midvein only . . . . . **16. S. leptacanthum**
8. Fruits globose with obtuse apex; leaf prickles on midvein and lateral veins . . . . . **13. S. gibbsiae**

9 Inflorescence rachis 30–65 mm long **10**
9. Inflorescence rachis 0–12 mm long **11**

10 Fruiting pedicels 11–15 mm long; lower surface of leaf sparsely stellate-hairy . . . . . **21. S. ortivum**
10. Fruiting pedicels 27–35 mm long; lower surface of leaf glabrous . . . **6. S. dallmannianum**

11 Glandular hairs (*c.* 0.1 mm long) present on vegetative growing tips . . . . **1. S. abortivum**
11. Glandular hairs absent **12**

12 Stellate hairs very sparse or absent from upper leaf surface **13**
12. Stellate hairs sparse to moderate density on upper leaf surface **15**

13 Branchlet prickles strongly recurved; habit sprawling and vine-like . . . . . **26. S. rivicola**
13. Branchlet prickles straight; habit erect and shrubby **14**

14 Branchlet prickles broad, 1–2 times longer than broad; leaves 2.3–3.4 times longer than broad; style 5.5–6 mm long . . . . . **2. S. anfractum**
14. Branchlet prickles narrower, 2–3 times longer than broad; leaves 1.6–2.1 times longer than broad; style 8–8.5 mm long . . . . . **24. S. phoberum**

15 Branchlet stellate hairs with swollen conical stalks; branchlet prickles 4–9 mm long . . . . . **17. S. malignum**
15. Branchlet stellate hairs sessile or with cylindrical stalks; branchlet prickles 2–4 mm long . . . . . **28. S. scolophyllum**

16 Upper surface of leaves glabrous, or with scattered stellate hairs along major veins **17**
16. Stellate hairs distributed throughout upper surface of leaf, very sparse to dense **21**

17 Prickles 3–70 on upper leaf surface **18**
17. Prickles absent from upper leaf surface **19**

18 Branchlet prickles recurved; stellate hairs on leaves 0.15–0.25 mm diameter, white . . . . . **12. S. galactites**
18. Branchlet prickles straight; stellate hairs on leaves 0.25–0.5 mm diameter, yellow to tan . . . . . **15. S. invictum**

19 Leaves 14–20 cm long; mature fruits c. 8 mm diameter; seeds 2.2–2.6 mm long; inflorescences frequently 2-branched . . . . . **20. S. oomsis**
19. Leaves 7–14 cm long; mature fruits 9–16 mm diameter; seeds 2.6–3.9 mm long; inflorescences always unbranched **20**

20 Stellate hairs with central ray 3–6 times longer than lateral rays . . . . . **11. S. fervens**
20. Stellate hairs with central ray 0.1–0.5 times longer than lateral rays . . . . . **8. S. discolor**

21 Lower side of fully expanded leaves very densely stellate hairy, obscuring leaf surface even at 40× magnification **22**
21. Lower side of fully expanded leaves moderately to densely stellate hairy, the leaf surface visible at 40× magnification **26**

22 Stellate hairs of the upper leaf surface with 2–8 ascending lateral rays, some or all with thick stalks, and usually interspersed with some simple (unbranched) hairs . . . . . **22. S. papuanum**
22. Stellate hairs of upper leaf surface sessile or with slender stalks, lateral rays porrect, simple hairs absent **23**

23 Leaves with conspicuous acute lobes . . . . . **5. S. borgmannii**
23. Leaves entire or with obscure obtuse lobes **24**

24 Branchlet prickles 4–8 times longer than broad; many stellate hairs on lower leaf surface with 9–14 lateral rays . . . . . **23. S. petilum**
24. Branchlet prickles 1–3.5 times longer than broad; all stellate hairs on lower leaf surface with 7–8 lateral rays **25**

25 Branchlet prickles 1.5–6 mm long; prickles on upper leaf surface (3–)5–70; stellate hairs very sparse to sparse on upper leaf surface . . . . **15. S. invictum**
25. Branchlet prickles 0.5–2.5 mm long; prickles on upper leaf surface absent or 1–3 on midrib; stellate hairs moderately dense on upper leaf surface . . . . . **3. S. arachnoides**

26 Stems with abundant needle-like prickles (400–500/dm) . . . . . **7. S. denseaculeatum**
26. Stems with sparser broad-based prickles (<80/dm) or stems unarmed. **27**

27 Most flowering or fruiting calyces bearing one or more prickles **28**
27. Calyx lacking prickles on all flowers or fruits **30**

28 Branchlet prickles recurved; rachis of inflorescence elongate, 15–22 mm long . . . . . **9. S. exemptum**
28. Branchlet prickles straight; rachis of inflorescence 1–4(–10) mm long **29**

29 Larger leaves 2–3.5 cm long; flowers 4-merous; all stellate hairs on leaves with broad conical base; inflorescence 1–2 flowered. . . . . **4. S. banzicum**
29. Larger leaves 4–8 cm long; flowers 5-merous; few or no stellate hairs on leaves with broad conical base; inflorescence 2–5 flowered . . . . **10. S. expedunculatum**

30 Prickles 5–34 on upper leaf surface; prickles 4–23 on lower leaf surface. . . . . **28. S. scolophyllum**
30. Prickles 0–6 on upper leaf surface; prickles 0–4 on lower leaf surface **31**

31 Stellate hairs on leaves 0.6–0.9 mm diameter; pedicels with glandular hairs . **19. S. nolense**
31. Stellate hairs on leaves 0.2–0.5 mm diameter; pedicels without glandular hairs **32**

32 Inflorescences branched; flowers 4-merous; petioles 7–14% length of lamina; branchlet prickles 50–13 per dm. . . . . **25. S. pluriflorum**
32. Inflorescences unbranched; flowers 5-merous; petioles 16–26% length of lamina; branchlet prickles 16–38 per dm. . . . . **30. S. trichostylum**

Enumeration of species

1. Solanum abortivum Symon, *J. Adelaide Bot. Gard.* 8: 93 (1985). **Type:** Papua New Guinea. Morobe Province: Middle slopes of Mt Missim, 2 June 1984, *D. Symon 13840 & A. Kairo* (holo: AD; iso: CANB; LAE *n.v.*).

For a description and discussion, see Symon (1985).

2. Solanum anfractum Symon, *J. Adelaide Bot. Gard.* 8: 93 (1985). **Type:** Papua New Guinea. Central Province: Trail ENE of Efogi village, 13 September 1970, *A. Kanis 1416* (holo: CANB; iso: BRI, L).

Erect perennial shrub, 0.6–4.5 m high. Sympodia bifoliate, geminate. Branchlets brown; prickles 0–30 per dm, straight, broad-based, 0.5–4 mm long, 1–2 times longer than wide, glabrous; branchlet stellate hairs absent, scattered or frequent, 0.3–0.6 mm diameter, stalks absent; lateral rays 5–8, porrect; central ray 0.1–0.3 times as long as laterals, not gland-tipped; simple hairs absent. Adult leaves elliptical, entire, 4.6–11.5 cm long, 2–3.4 cm wide, 2.3–3.4 times longer than broad; apex acute to acuminate, base cuneate, oblique part 0–2.5 mm long, obliqueness index 0–2 percent; petioles 0.6–1.9 cm long, 11–19% length of lamina, prickles absent. Upper leaf surface dark green; prickles absent or present on midvein only or on midvein and lateral veins, 0–9, straight, broad-based, 1–9 mm long; stellate hairs confined to major veins or distributed throughout, hairs absent to sparsely distributed, 0.5–10 mm apart, 0.25–0.4 mm across, sessile, lateral rays 7–8, porrect; central ray 0.4–0.6 times as long as laterals, not gland-tipped; simple hairs absent. Lower leaf surface green; prickles absent or present or on midvein only or on midvein and lateral veins, 0–10; stellate hairs absent or very sparse to sparse, 0.5–10 mm apart, 0.2–0.4 mm diameter, stalks absent; lateral rays 6–8, porrect; central ray 0.3–0.5 times as long as laterals, not gland-tipped; simple hairs absent. Inflorescence leaf-opposed or supra-axillary, unbranched; common peduncle 0–6 mm long; rachis 1–12 mm long, prickles absent or occasionally present; 1–3-flowered, with all flowers bisexual, (4–)5-merous; pedicels at anthesis 15–29 mm long, 0.4–0.5 mm thick,

same thickness throughout, prickles absent. Calyx tube at anthesis 1.5–2 mm long; calyx lobes at anthesis deltate to attenuate, 1–5.5 mm long; calyx prickles absent; calyx stellae sparse to moderately dense, white, 0.2–0.5 mm across, stalks absent, lateral rays 4–8, central ray 0.5–1.5 times as long as laterals, not gland-tipped, simple hairs absent. Corolla violet to bluish, 9–13 mm long, shallowly to deeply lobed, inner surface glabrous or with sparse stellate hairs; anthers 4.9–5.3 mm long; filaments 1.2–1.5 mm long; ovary glabrous or with dense stellate hairs; functional style 5.5–6 mm long, protruding between anthers, glabrous or with scattered stellate hairs. Fruiting calyx lobes less than or more than half length of mature fruit, prickles absent; mature fruits 1–2 per inflorescence, globose, 10–12 mm diameter, red at maturity; pedicels 27–32 mm long, cylindrical or thicker towards apex, *c.* 0.4 mm thick at midpoint. Seeds pale yellow, 5.3–5.9 mm long, with broad annular wing.

***Additional specimens examined*: Papua New Guinea.** Morobe Province: Spreader Divide, between Aseki and Menyamya, Nov 1970, *Streimann & Kairo NGF42460* (BRI); Aseki, slope of Angabena ridge, Jan 1972, *Streimann & Stevens LAE53987* (BRI); Mt Missim, Kuper Range, Wau, Aug 1985, *Wada et al. 93* (BRI). Western Highlands Province: Ridge community near Camp 1, Mt Oibo, Bismarck Range, Oct 1995, *Takeuchi 10530* (AD, L, NY). Southern Highlands Province: Between Nol and Mendi, 24 km from Mendi, Jun 1977, *Symon 10689 & Katik* (AD); *ibid.*, Jun 1977, *Symon 10692 & Katik* (AD); Vicinity of the Hides 3 natural gas well-head, Apr 2005, *Takeuchi et al. 19014* (CANB, L). Eastern Highlands Province: Marafunga, *c.* 20 miles [32 km] NW of Goroka, Oct 1964, *Hartley 13214* (CANB); Kassam Pass, Kainantu subdistrict, Jan 1968, *Henty & Coode NGF29195* (BRI); Crater Mt Wildlife Management area, Abegarama, ridge above Beavetai airstrip, Aug 1998, *Takeuchi 12912* (CANB, L); Aiyura, Jul 1954, *Womersley 6014* (BRI). Madang Province: Kaironk Valley, Schrader Range, Dec 1999, *Gardner 9965* (AD). Northern Province: E side, Lake Myola 1, subdistrict Kokoda, Jul 1974, *Croft et al. LAE65003* (BRI). Central Province: E slope of Lake Myola No. 2, Sep 1973, *Croft & Lelean NGF34552* (BRI); Trail ENE of Efogi village, Sep 1970, *Kanis 1416* (BRI, CANB). Milne Bay Province: Mt Mon, E of Bonenau village, Aug 1969, *Pullen 8043* (A).

***Distribution and habitat*:** As currently circumscribed, *Solanum anfractum* has a very considerable distribution from the Southern Highlands to the ranges east of Port Moresby (**Map 1**). It grows at altitudes from 1280 to 2600 metres, in mossy montane or submontane rainforest, beech forest, or *Castanopsis* forest. Unlike many other species of the *S. ferocissimum* group, *S. anfractum* has often been collected from primary forest.

***Phenology*:** Flowers and fruits are recorded from June to January.

***Notes*:** There is much variation in *Solanum anfractum*. Specimens from the type locality and several other localities are completely unarmed, but those from the Southern and Western Highlands are conspicuously prickly on their leaves and branchlets. These prickly forms may constitute another taxon. The few seed-bearing specimens exhibit extraordinarily large seeds, with a broad annular wing; it is not known whether this is a constant feature for *S. anfractum*. Differences in the style and ovary indumentum and the calyx lobe shape and length may also indicate hidden taxa within *S. anfractum*.

3. Solanum arachnoides A.R.Bean **sp. nov.** With affinity to *S. papuanum* Symon, but differing by the smaller sessile stellate hairs on the lower leaf surface, the smaller stellate hairs of the upper leaf surface, the often branched inflorescence, the longer anthers, and the smaller fruits. **Typus:** Papua New Guinea. Morobe Province. Aseki Road, near crest, 31 May 1984, *D.E. Symon 13826* (holo: CANB [3 sheets]; iso: AD, L).

Erect perennial shrub, 0.75–3.5 m high. Sympodia bifoliate, geminate or disjunct. Branchlets brown; prickles 10–26 per dm, straight, broad-based, 1–3 mm long, 1–2.5 times longer than wide, with stellate hairs throughout lower part; branchlet stellate hairs dense to very dense, 0.25–0.35 mm diameter, stalks 0–0.05 mm long; lateral rays 7–8, porrect; central ray 0–0.1 times as long as laterals, not gland-tipped; simple hairs absent. Adult leaves ovate to elliptical, entire, 3.4–6 cm long, 1.5–3.5 cm wide, 1.7–2.8 times longer than broad; apex acute, base cuneate, oblique part 0–2 mm long, obliqueness index 0–3 percent; petioles 0.5–1.1 cm long, 15–22% length of lamina, prickles absent or rarely present. Upper leaf surface green; prickles

absent or sometimes present on midvein only, 0–3, straight, broad-based, 2–4 mm long; stellate hairs distributed throughout, sparse to moderately dense, 0.2–0.4 mm apart, 0.15–0.25 mm across, sessile, lateral rays 7–8, porrect; central ray 0–0.1 times as long as laterals, not gland-tipped; simple hairs absent. Lower leaf surface yellow to rusty; prickles absent; stellate hairs very dense, 0–0.05 mm apart, 0.15–0.3 mm diameter, stalks 0–0.05 mm long; lateral rays 7–8, porrect; central ray 0–0.1 times as long as laterals, not gland-tipped; simple hairs absent. Inflorescence supra-axillary, unbranched or 2-branched or 3-branched; common peduncle 0–3 mm long; rachis 0–21 mm long, prickles absent or occasionally present near base; 7–17-flowered, with all flowers bisexual, 5-merous; pedicels at anthesis 8–9 mm long, 0.5–0.7 mm thick, same thickness throughout, prickles absent. Calyx tube at anthesis 1–2 mm long; calyx lobes at anthesis elliptic, 0.5–1 mm long; calyx prickles absent; calyx stellae very dense, yellow, 0.2–0.3 mm across, stalks 0–0.1 mm long, lateral rays 7–8, central ray 0–0.1 times as long as laterals, not gland-tipped, simple hairs absent. Corolla mauve to purple, 9–12 mm long, shallowly lobed, inner surface with very sparse stellate hairs; anthers 4–4.6 mm long; filaments 1–1.9 mm long; ovary with sparse tiny glandular hairs; functional style 6.5–7.5 mm long, protruding between anthers, with sparse tiny glandular hairs towards base, otherwise glabrous. Fruiting calyx lobes less than half length of mature fruit, prickles absent; mature fruits 6–14 per inflorescence, globose, 6–7 mm diameter, dull red (*Symon 13826*) at maturity; pedicels 17–29 mm long, thicker towards apex, 0.8–0.9 mm thick at midpoint. Seeds yellow, 2.5–2.6 mm long. **Figs. 1, 2.**

***Additional specimens examined*: Papua New Guinea.** Morobe Province: Ekuti divide, Bulolo – Aseki Road, 35 km WSW of Bulolo, Jun 1982, *Streimann 8383* (L); Aseki Road, near crest, May 1984, *Symon 13826* (AD, CANB, L); Aseki Road from Bulolo, near crest, May 1984, *Symon 13825* (AD, L, NY); Ekuti Divide on Bulolo – Aseki Road, Feb 1993, *Takeuchi 8831* (AD, BRI).

***Distribution and habitat*:** *Solanum arachnoides* is known only from the Bulolo – Aseki road, in the Morobe province (**Map 3**), at altitudes between 2100 and 2200 metres. It grows on roadsides adjacent to montane forest.

***Phenology*:** Flowers and fruits have been recorded for February, May and June.

***Notes*:** *Solanum arachnoides* is morphologically most similar to *S. papuanum*, but differs by the sessile stellate hairs on the lower leaf surface, 0.15–0.3 mm diameter (long stalked, 0.45–0.6 mm diameter for *S. papuanum*); simple hairs absent (present for *S. papuanum*); porrect stellae on upper leaf surface, 0.15–0.25 mm across (ascending stellate hairs 0.3–0.8 mm diameter for *S. papuanum*).

Aubriot *et al.* (2016) have attributed *Symon 13826*, with its moderately long rachis, to *S. trichostylum,* and it forms their sole voucher for *S. trichostylum*. *Streimann 8383*, which has a very short rachis, has been attributed to *S. expedunculatum,* and it forms one of two vouchers they used for *S. expedunculatum*. Both specimens are included here under *S. arachnoides*.

***Etymology*:** The specific epithet is from the Greek *arachne* (spider), and *–oides* (resembling). The usually 8-rayed hairs of the upper leaf surface resemble a horde of tiny spiders.

4. Solanum banzicum A.R.Bean **sp. nov.** With affinity to *S. expedunculatum* Symon, but differing by the 4-merous flowers, the 1–2-flowered inflorescences, the smaller leaves with very short petioles, and by the broad conical base possessed by all stellate hairs on the leaves and branchlets. **Typus:** Papua New Guinea. Western Highlands Province. Waghi – Sepik divide, 9 km N of Banz, 7 July 1982, *H. Streimann 8467* (holo: BRI; iso: L; LAE *n.v.*).

Erect or sprawling perennial shrub to 1 m high. Sympodia bifoliate, geminate or disjunct. Branchlets brown; prickles 13–29 per dm, straight, broad-based, 1.5–4 mm long, 1–2 times longer than wide, with scattered stellate hairs on lower part; branchlet stellate hairs frequent to dense, 0.5–1 mm diameter, stalks 0.1–0.5 mm long, broad, conical; lateral rays 4–8, porrect; central ray 0.6–1.2 times as long

Fig. 1. Holotype of ***Solanum arachnoides*** (*Symon 13826*, CANB).

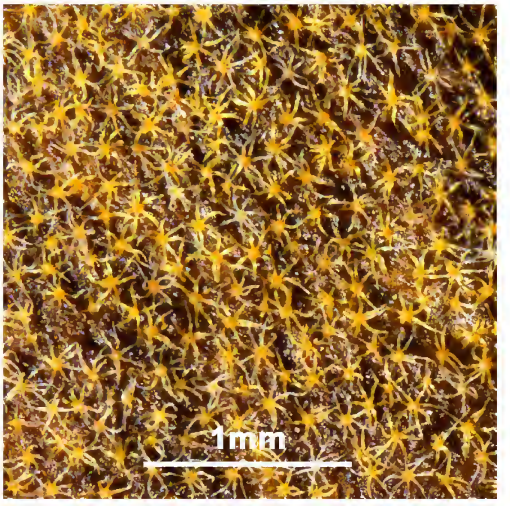

Fig. 2. Stellate hairs on upper leaf surface of ***Solanum arachnoides*** (*Symon 13826*, CANB).

as laterals, often deflexed, not gland-tipped; simple hairs absent. Adult leaves broadly ovate, entire, 2.2–3.6 cm long, 1.2–1.9 cm wide, 1.3–1.9 times longer than broad; apex acute to acuminate, base cuneate or obtuse, oblique part 0–2 mm long, obliqueness index 0–9 percent; petioles 0.3–0.5 cm long, 14–22% length of lamina, prickles present. Upper leaf surface green; prickles present on midvein and lateral veins or on midrib only, 2–10, straight, broad-based, 2.5–5 mm long; stellate hairs distributed throughout, dense, 0.2–0.4 mm apart, 0.4–1 mm across, stalks 0.1–0.3 mm long, broad, conical; lateral rays 1–6, ascending; central ray 1–1.5 times as long as laterals, not gland-tipped; simple hairs often present, 0.5–2 mm apart, 0.2–0.7 mm long. Lower leaf surface rusty; prickles 1–4 along midvein and lateral veins or on midvein only; stellate hairs dense, 0.25–0.5 mm apart, 0.5–1 mm diameter, stalks 0.1–0.6 mm long; lateral rays 4–8, porrect or ascending; central ray 1–1.5 times as long as laterals, not gland-tipped; simple hairs absent. Inflorescence supra-axillary, unbranched; common peduncle 0–1 mm long; rachis 1–3 mm long, prickles absent or present; 1 or 2-flowered, with all flowers bisexual, 4-merous; pedicels at anthesis 8–21 mm long, 0.5–0.7 mm thick, same thickness throughout, prickles present or absent. Calyx tube at anthesis 1.5–2.5 mm long; calyx lobes at anthesis rostrate, 3.5–6 mm long; calyx prickles usually present, 0–5, 1–2 mm long; calyx stellae moderately dense to dense, rusty, 0.5–0.7 mm across, stalks 0.1–0.25 mm long, lateral rays 4–8, central ray 1–1.5 times as long as laterals, not gland-tipped, simple hairs absent. Corolla white, 11–12 mm long, shallowly to deeply lobed, inner surface with very sparse stellate hairs along lobe midveins; anthers 4.8–5.3 mm long; filaments 1.2–1.8 mm long; ovary glabrous or with a few tiny glandular hairs; functional style 7.5–8 mm long, protruding between anthers, with sparse tiny glandular hairs towards base and sometimes a few stellate hairs, otherwise glabrous. Fruiting calyx lobes less than or more than half length of mature fruit, prickles often present; mature fruits 1–2 per inflorescence, globose, mature fruits not seen; pedicels of immature fruits 20–28 mm long, same thickness throughout, 0.5–0.7 mm thick at midpoint. **Figs. 3, 4.**

***Additional specimens examined*: Papua New Guinea.** Western Highlands Province: Waghi – Sepik divide, 9 km N of Banz, Jul 1982, *Streimann 8467* (BRI, L); *ibid.*, Jul 1982, *Streimann 8473* (BRI, L); On the Waghi – Sepik divide, about the crest, 17 km from Banz and *c.* 45 km from Tabibuga, Jun 1977, *Symon 10702* (AD, L); On the Waghi – Sepik divide between Banz and Tabibuga near the crest of the divide *c.* 20 km from Banz, Jun 1977, *Symon 10706* (AD).

***Distribution and habitat*:** *Solanum banzicum* is known only from a small area of the Western Highlands (**Map 3**) at altitudes between 2200 and 2400 metres. Its recorded habitats are "regrowth on ridge" and "roadside spill".

***Phenology*:** Flowers and immature fruits are recorded for June and July.

***Notes*:** The specimens of *Solanum banzicum* cited above were included by Symon (1985) in *S. expedunculatum*. *S. banzicum* is closely related to *S. expedunculatum*, but differs by the 4-merous flowers, the 1–2-flowered inflorescences, the smaller leaves with very short petioles, and all stellate hairs on the leaves and branchlets having broad conical bases. The type locality of *S. banzicum* is more than 70 km from the nearest known population of *S. expedunculatum*.

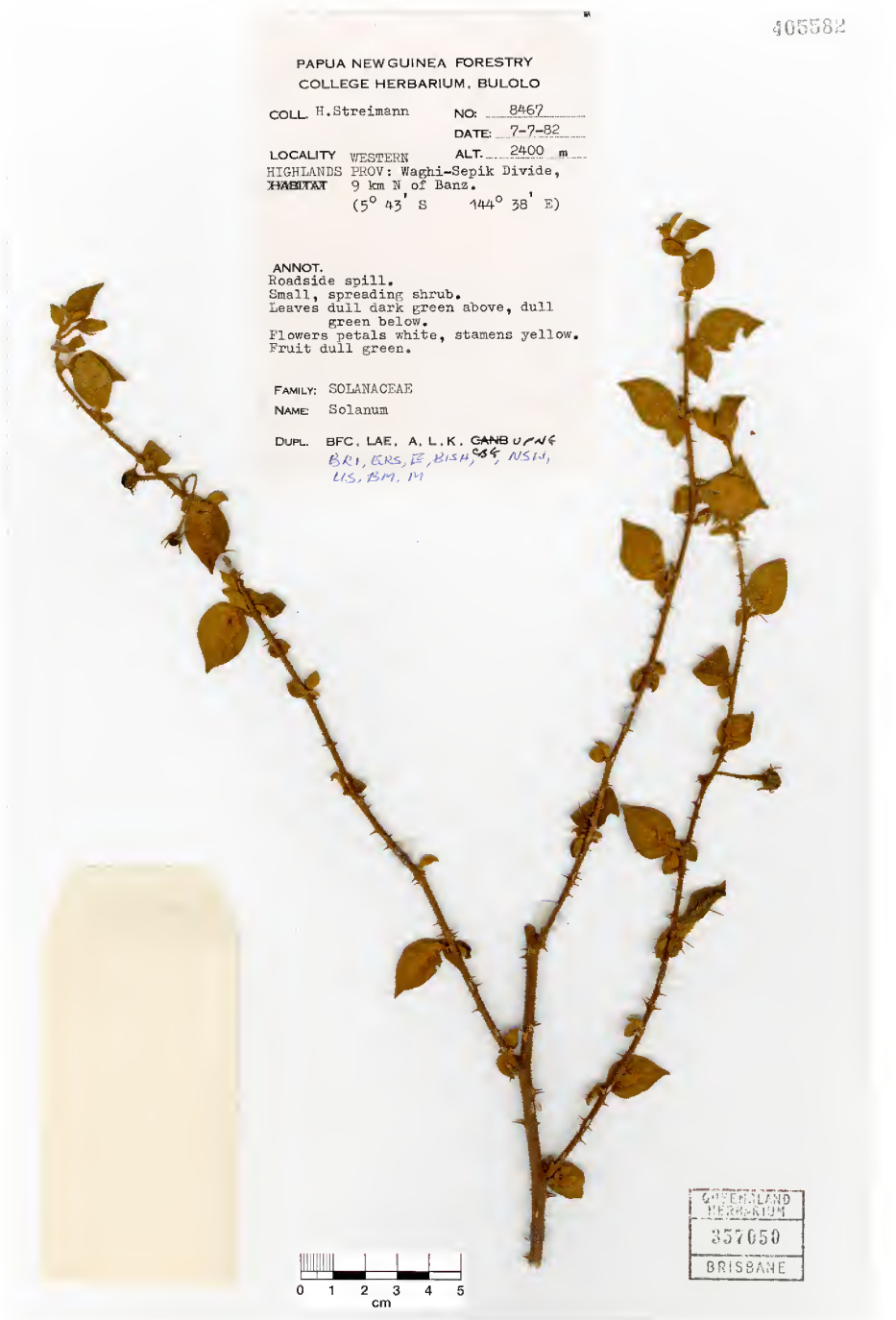

Fig. 3. Holotype of ***Solanum banzicum*** (*Streimann 8467*, BRI).

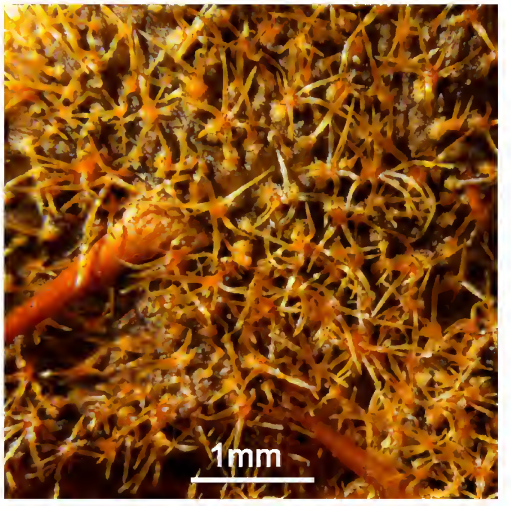

Fig. 4. Stellate hairs on upper leaf surface of ***Solanum banzicum*** (*Streimann 8467*, BRI).

***Etymology*:** The specific epithet refers to the village of Banz, near where the type was collected.

5. Solanum borgmannii Symon, *J. Adelaide Bot. Gard.* 8: 97 (1985). **Type:** Papua New Guinea. Simbu Province: Komanimambino, slopes of Mt Wilhelm, 29 September 1960, *E. Borgmann 213* (holo: L; iso: LAE *n.v.*).

For a description and discussion, see Symon (1985).

6. Solanum dallmannianum Warb., *Bot. Jahrb. Syst.* 13: 415 (1890). **Type:** Papua New Guinea. Morobe Province: Sattelburg, *s.dat.*, [*A.A.*]*Dallmann s.n.* (holo: B, destroyed).

For a description and discussion, see Symon (1985).

7. Solanum denseaculeatum Symon, *J. Adelaide Bot. Gard.* 8: 100 (1985). **Type:** Papua New Guinea. Morobe Province: Golden Pines Logging Area, Watut, 20 October 1965, *H. Streimann & A. Kairo NGF21198* (holo: BRI; iso: A, BRI, CANB, K, L; LAE, NSW all *n.v.*).

For a description and discussion, see Symon (1985).

8. Solanum discolor R.Br., *Prodr. 445* (1810). **Type:** Queensland. Cook District: 'Coen river' [Pennefather River], Carpentaria, 7 November 1802, *R. Brown s.n.* (lecto: BM 000596891), *fide* Symon (1981: 40).

Solanum turraeifolium S.Moore, *J. Bot.* 61, *suppl.* 37 (1927), as 'turraeaefolium'. **Type:** New Guinea. Central Province: Near Kerepunu, Sogeri distict, 1885–1886, *H.O. Forbes s.n.* (holo: BM 000886282), ***syn. nov.***

Solanum yirrkalense Symon, *J. Adelaide Bot. Gard.* 4: 137 (1981), as 'yirrkalensis'. **Type:** Northern Territory. Yirrkala gardens, 27 February 1976, *D. Hinz 7633* (holo: DNA [ex NT]; iso: BRI, CANB, DNA), ***syn. nov.***

For a description, see Bean (2004).

***Additional selected specimens examined*: Papua New Guinea.** Central Province: Hisiu, Feb 1935, *Carr 11401* (CANB, L, NY); near Hisiu, Kairuku subdistrict, Aug 1962, *Pullen 3546* (CANB); Tovobada Hills, E footslopes, 12 miles [19 km] N of Port Moresby, May 1965, *Heyligers 1164* (CANB, L); Bioto, Aug 1918, *C.T. White 581* (BRI).

***Distribution and habitat*:** *Solanum discolor* is found at the extreme north-east of the Northern Territory, on the Cape York Peninsula of Queensland, north of latitude 14 degrees, and in the Central province of Papua New Guinea, close to Port Moresby (**Map 2**). All occurrences are at low altitude (<100 metres), where it occurs on the edges of lowland or littoral rainforest, on sandy soils.

***Phenology*:** In Papua New Guinea, flowers are recorded for February and May; fruits in February, May and August.

***Notes*:** Symon (1981) named *Solanum yirrkalense* from a single location in the Northern Territory, Australia. He stated that it differed from *S. corifolium* F.Muell. and *S. discolor* by the "broad leaves, white rather than pale blue flowers, and relatively large berries". Bean (2004) did not consider any of these differences to be significant or consistent, but he separated *S. yirrkalense* from *S. discolor* by the sparser indumentum of the lower leaf surface and the longer common peduncles of the cymes. After consideration of New Guinea material and some additional Australian material, it has become clear that

these characters are also unreliable, with peduncle length being quite variable and the stellate hair density apparently reflecting the microhabitat and/or the stage of growth of the plant. As a consequence, *S. yirrkalense* is here reduced to synonymy under *S. discolor*. *S. turraeifolium* is also relegated to synonymy; its type is virtually identical in appearance to the lower branchlet of the lectotype of *S. discolor*, and its micro-morphological features also agree with those of *S. discolor*.

9. Solanum exemptum A.R.Bean **sp. nov.** With affinity to *S. rivicola* Symon but differing by the greater number of prickles on the lower leaf surface, the moderately dense stellate hairs of the lower leaf surface with a shorter central ray, the inflorescence 9–14 flowered with a common peduncle and elongated rachis, the thicker pedicels, the attenuate calyx lobes; and the larger shallowly-lobed corolla. **Typus:** Papua New Guinea. Milne Bay Province: Mayu 2, Raba Raba subdistrict, 15 July 1972, *P.F. Stevens & J.F. Veldkamp LAE55565* (holo: BRI; iso: CANB, L; LAE *n.v.*).

Sprawling plant to 0.4 m high, rooting at the nodes. Sympodia bifoliate, disjunct. Branchlets brown; prickles 56–80 per dm, slightly recurved, broad-based, 1–4.5 mm long, 2–3 times longer than wide, glabrous throughout or with sparse stellate hairs attached; branchlet stellate hairs dense, 0.4–0.6 mm diameter, stalks 0–0.2 mm long; lateral rays 7–8, porrect; central ray 0–0.2 times as long as laterals, not gland-tipped; simple hairs absent. Adult leaves elliptical, entire, 3.1–4 cm long, 1.5–1.8 cm wide, 2.1–2.4 times longer than broad; apex acute to acuminate, base cuneate, oblique part 0–2 mm long, obliqueness index 0–6 percent; petioles 0.5–0.75 cm long, 13–19% length of lamina, prickles present. Upper leaf surface green; prickles present on midvein and lateral veins, 7–18, straight, broad-based, 3–7 mm long; stellate hairs distributed throughout, hairs sparse to moderately dense, 0.2–0.3 mm apart, 0.25–0.55 mm across, sessile, lateral rays 4–7, porrect; central ray 0.3–0.6 times as long as laterals, not gland-tipped; simple hairs absent. Lower leaf surface yellowish-green; prickles 16–28, present on midvein and lateral veins; stellate hairs moderately dense, 0.15–0.25 mm apart, 0.25–0.5 mm diameter, stalks 0–0.05 mm long; lateral rays 4–8, porrect; central ray 0.1–0.4 times as long as laterals, not gland-tipped; simple hairs absent. Inflorescence supra-axillary, unbranched; common peduncle present, 2–6 mm long; rachis present, 15–22 mm long; 9–14-flowered, with all flowers seemingly bisexual, 5-merous; pedicels at anthesis 7–15 mm long, 0.3–0.4 mm thick, same thickness throughout, prickles present. Calyx tube at anthesis 2–3 mm long; calyx lobes at anthesis attenuate, 2.5–3.5 mm long; calyx prickles almost always present; calyx stellae moderately dense to dense, yellow, 0.25–0.4 mm across, stalks 0–0.1 mm long, lateral rays 6–8, central ray 0.5–1 times as long as laterals, not gland-tipped, simple hairs absent. Corolla purple, *c.* 15 mm long, shallowly lobed, inner surface with sparse stellate hairs; anthers 6–6.2 mm long; filaments 2.3–2.5 mm long; functional style *c.* 8 mm long, protruding between anthers, with sparsely scattered tiny glandular hairs. Fruiting material not seen. **Figs. 5, 6.**

***Additional specimens examined*:** Known only from the type.

***Distribution and habitat*:** *Solanum exemptum* is known only from the Mayu River, near Mt Suckling in Milne Bay province (**Map 4**). The recorded altitude is 1760 metres. The type was located on a "bare sandy place by river".

***Phenology*:** Flowers are recorded for July.

***Notes*:** The type specimen of *Solanum exemptum* was included by Symon (1985) in *S. rivicola*. It differs from *S. rivicola* by the 16–28 prickles on the lower leaf surface (5–13 prickles for *S. rivicola*), the moderately dense stellate hairs of the lower leaf surface with central ray 0.1–0.4 times as long as laterals (very sparse to sparse stellate hairs, central ray 0.5–1.6 times for *S. rivicola*), the inflorescence 9–14-flowered with a common peduncle and elongated rachis (inflorescence 1–2-flowered, both common peduncle and rachis absent for *S. rivicola*), the pedicels 0.3–0.4 mm thick at anthesis (0.15–0.25 mm thick for *S. rivicola*), the attenuate calyx lobes

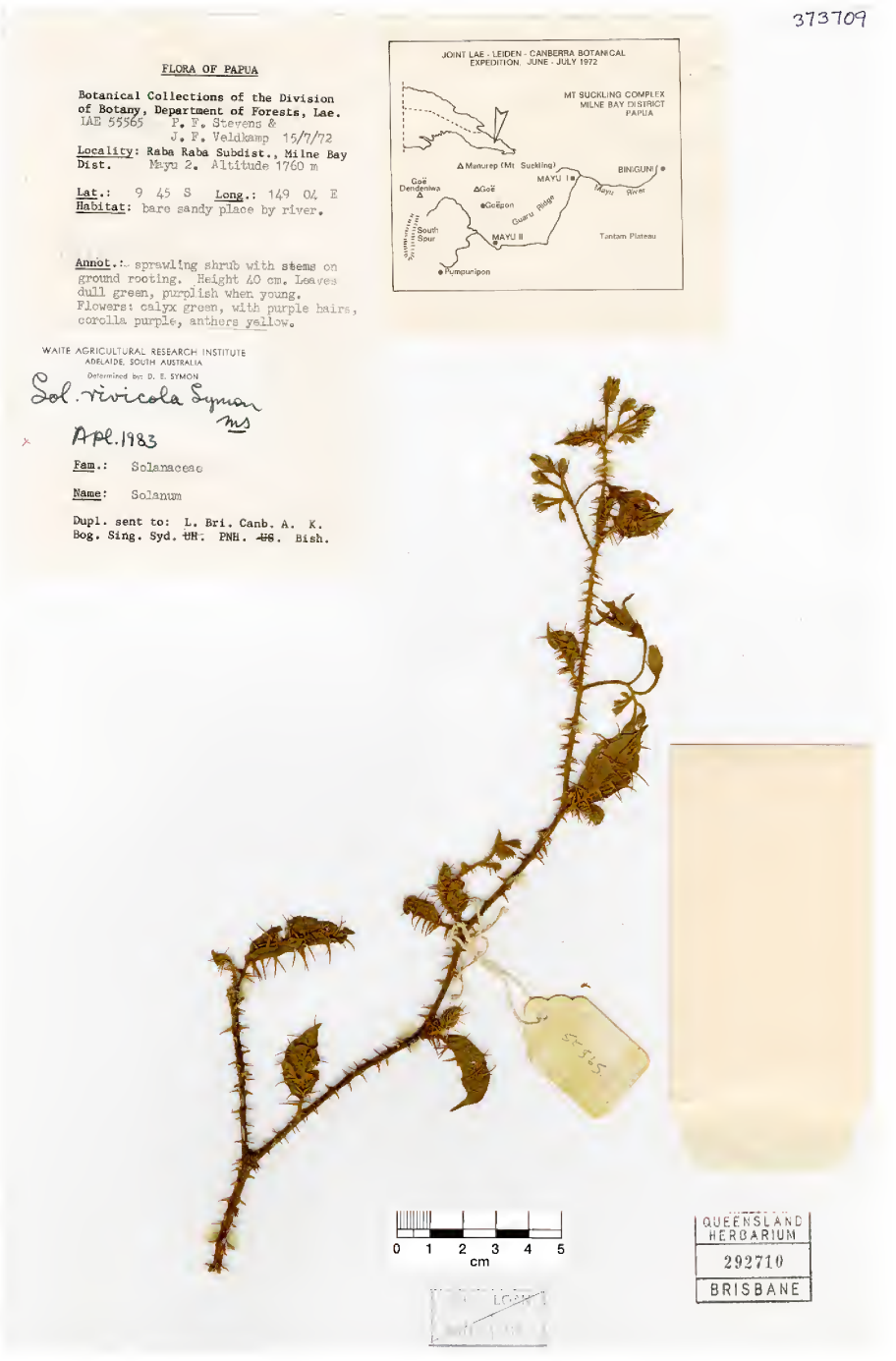

Fig. 5. Holotype of ***Solanum exemptum*** (*Stevens & Veldkamp LAE55565*, BRI).

Fig. 6. Two inflorescences of ***Solanum exemptum*** (*Stevens & Veldkamp LAE55565*, BRI).

(elliptic for *S. rivicola*); and the shallowly-lobed corolla *c.* 15 mm long (deeply lobed, 7–12 mm long for *S. rivicola*).

***Etymology*:** The specific epithet is from the Latin *exemptus,* meaning 'taken out, removed or released'. This alludes to the notion that this species was taken out of *S. rivicola*, under which it was previously included.

10. Solanum expedunculatum Symon, *J. Adelaide Bot. Gard.* 8: 103 (1985). **Type:** Papua New Guinea. Eastern Highlands Province: Top of Daulo Pass, 22 June 1977, *D.E. Symon & P. Katik 10675* (holo: AD; iso: AD, BRI, CANB, K; F *n.v.*).

Erect or sprawling perennial shrub, 0.6–3 m high. Sympodia bifoliate, disjunct. Branchlets brown or rusty; prickles 25–42 per dm, straight, broad-based, 2–4.5 mm long, 1.5–4 times longer than wide, with stellate hairs throughout lower part; branchlet stellate hairs dense, 0.6–0.9 mm diameter, stalks 0–0.25 mm long, slender, cylindrical; lateral rays 7–8, porrect or ascending; central ray 1–2.5 times as long as laterals, not gland-tipped; simple hairs absent. Adult leaves ovate to elliptical, entire, 4.3–8.1 cm long, 1.9–3.8 cm wide, 1.6–2.3 times longer than broad; apex acute to acuminate, base cuneate or obtuse, oblique part 0–1.5 mm long, obliqueness index 0–2 percent; petioles 0.6–1.9 cm long, 14–32% length of lamina, prickles present or rarely absent. Upper leaf surface green; prickles present on midvein and lateral veins, 4–43, straight, broad-based, 2–4 mm long; stellate hairs distributed throughout, dense, 0.2–0.4 mm apart, 0.3–0.8 mm across, stalks 0–0.25 mm long, slender, cylindrical; lateral rays 3–12, porrect or ascending or multiradiate; central ray 1–3 times as long as laterals, not gland-tipped; simple hairs sometimes present, 0.15–0.8 mm apart, 0.2–0.7 mm long. Lower leaf surface rusty; prickles absent or 6–20 present along midvein and lateral veins; stellate hairs dense, 0.15–0.3 mm apart, 0.5–0.8 mm diameter, stalks 0–0.2 mm long; lateral rays 7–12, porrect or multiradiate; central ray 1–3 times as long as laterals, not gland-tipped; simple hairs absent. Inflorescence supra-axillary, unbranched; common peduncle 0–4 mm long; rachis 0–12 mm long, prickles absent or present; 2–5-flowered, with all flowers bisexual, 5-merous; pedicels at anthesis 7–25 mm long, 0.6–0.7 mm thick, same thickness throughout or broader near apex, prickles present. Calyx tube at anthesis 1.5–3 mm long; calyx lobes at anthesis rostrate, 2.5–5.5 mm long; calyx prickles present, 3–28, 1–4 mm long; calyx stellae moderately dense to dense, rusty, 0.3–0.7 mm across, stalks 0–0.1 mm long, lateral rays 7–8, central ray 1.5–3 times as long as laterals, not gland-tipped, simple hairs absent. Corolla white (occasionally tinged with purple), 13–14 mm long, shallowly lobed, inner surface with sparse stellate hairs; anthers 4.5–4.8 mm long; filaments 2.0–2.3 mm long; ovary with sparse tiny glandular hairs; functional style *c.* 8.3 mm long, protruding between anthers, with sparse tiny glandular hairs towards base, otherwise glabrous. Fruiting calyx lobes less than half length of mature fruit, prickles present; mature fruits 1–3 per inflorescence,

globose, 10–12 mm diameter, reddish-orange (*Vandenberg & Womersley NGF35007*) or red (*Symon & Katik 10700*; *Stevens LAE51095*) at maturity; pedicels 23–35 mm long, thicker towards apex, 0.8–0.9 mm thick at midpoint. Seeds yellow, *c.* 3.2 mm long.

***Additional specimens examined*:** Papua New Guinea. Eastern Highlands Province: Fatima River, Marafunga, subdistrict Goroka, Nov 1968, *Millar NGF40708* (BRI, L); Marafunga, extension area 1, by Fatima River, Nov 1970, *Stevens LAE51095* (BRI, L); Top of Daulo Pass, Jun 1977, *Symon & Katik 10675* (AD, BRI, L); E slope of Daulo, Jun 1977, *Symon 10680* (AD); Marafunga Logging Area, Goroka sub-district, May 1968, *Vandenberg & Womersley NGF35007* (BRI, L). Southern Highlands Province: SE slopes of Mt Giluwe, Jun 1977, *Symon & Katik 10700* (AD, L).

***Distribution and habitat*:** *Solanum expedunculatum* is known mainly from the Marafunga and Daulo Pass area of the Eastern Highlands province, but there is also an occurrence near Mount Giluwe in the Southern Highlands (**Map 2**). Altitude varies from 2100 to 2600 metres. It grows in disturbed areas of logged forest and on roadsides.

***Phenology*:** Flowers and fruits are recorded for May, June and November.

***Notes*:** Symon (1985) stated that the name of this species was given because of the "virtual absence of a peduncle to the reduced inflorescences", and it seems that his specimen determinations were greatly influenced by this characteristic. This has resulted in the grouping of a number of specimens that have numerous morphological disparities. In this account, *S. expedunculatum* is considered to be confined to a relatively small area of the Eastern and Southern Highlands.

11. Solanum fervens A.R.Bean, *Austrobaileya* 6: 686 (2004). **Type:** Queensland. Cook District: Eastern bank of Jardine River mouth, 1 September 1985, *J.R. Clarkson 6219* (holo: BRI [1 sheet + spirit]; iso: AD, CNS).

Illustrations: Symon (1985: 128), as *S. turraeaefolium*; Bean (2004: 687).

For a description, see Bean (2004).

***Additional specimens examined*:** Papua New Guinea. Central Province: Tavai Creek area, *c.* 43 miles [69 km] SE of Port Moresby, May 1967, *Pullen 6872* (CANB, L); Boku, Nov 1909, *Schlencker s.n.* (BRI [AQ80466]).

***Distribution and habitat*:** *Solanum fervens* occurs in the northern part of Cape York Peninsula, Queensland, and in the Central province of Papua New Guinea, where it is known from two sites (**Map 2**). It occurs in monsoon forest on low hills, where the elevation is around 150 metres.

***Phenology*:** Flowers are recorded for May; fruits in May and November.

***Notes*:** The two specimens cited above were included by Symon (1985) under *Solanum turraeifolium* (= *S. discolor*). However, these specimens have a very long central ray on the stellate hairs of the leaves and branchlets, and are a very good match for specimens of *S. fervens* from Cape York Peninsula, Queensland, including the type.

12. Solanum galactites A.R.Bean **nom. nov.**; *Solanum heteracanthum* Merr. & L.M.Perry, *J. Arn. Arbor.* 30: 48 (1949), *nom. illeg. non* Dunal (1813).

For a description and discussion, see Symon (1985) as *S. heteracanthum*.

***Note*:** This species requires a new name because the epithet chosen by Merrill and Perry had already been validly published by Dunal in 1813.

***Etymology*:** The replacement epithet is from the Greek *galaktites* meaning milk-like, referring to the milky-white undersides of the leaves.

13. Solanum gibbsiae J.R.Drumm. in Gibbs, *Fl. Arfak Mts.* 177 (1917). **Type:** Indonesia. West Papua. Angi Lakes, Arfak Mountains, December 1913, *L.S. Gibbs 5974* (holo: BM).

For a description and discussion, see Symon (1985).

14. Solanum infuscatum Symon, *J. Adelaide Bot. Gard.* 8: 107 (1985). **Type:** Papua New Guinea. Morobe Province: Arigenang village, 14 February 1970, *D.B. Foreman NGF48100* (holo: LAE *n.v.*; iso: BRI, CANB, L).

For a description and discussion, see Symon (1985).

15. Solanum invictum A.R.Bean **sp. nov.** With affinity to *S. trichostylum* Merr. & L.M.Perry, but differing by the longer prickles on the branchlets, the more numerous prickles on the upper leaf surface, the glabrous or very sparsely hairy upper leaf surface, the very densely hairy lower leaf surface, and the style with dense stellate hairs only at the base. **Typus:** Papua New Guinea. Central Province: SE slope to Mt Victoria Range, Port Moresby subdistrict, 7 July 1974, *J. Croft & G. Larivita LAE61684* (holo: BRI; iso: A, CANB, L; LAE *n.v.*).

Erect perennial shrub, 1–2.5 m high. Sympodia bifoliate, geminate or disjunct. Branchlets yellow to dark brown; prickles 22–70 per dm, straight or curved, broad-based, 1–6 mm long, 1.5–3.5 times longer than wide, with stellate hairs throughout lower part; branchlet stellate hairs dense to very dense, 0.3–0.4 mm diameter, stalks 0–0.1 mm long; lateral rays 6–8, porrect; central ray 0.5–1.2 times as long as laterals, not gland-tipped; simple hairs absent. Adult leaves ovate to broadly ovate, entire or repand, 6.8–12.8 cm long, 3.3–9 cm wide, 1.4–2.8 times longer than broad; apex acute to acuminate, base cuneate or obtuse, oblique part 0–5 mm long, obliqueness index 0–5 percent; petioles 1.2–3.3 cm long, 16–26% length of lamina, prickles present. Upper leaf surface dark green; prickles present on midvein and lateral veins, rarely on midvein only, (3–)5–60, straight, broad-based, 2.5–7 mm long; stellate hairs confined to major veins or distributed throughout, hairs absent or very sparsely distributed, 0.7–4 mm apart, 0.4–0.5 mm across, sessile, lateral rays 7–8, porrect; central ray 0.5–0.8 times as long as laterals, not gland-tipped; simple hairs absent. Lower leaf surface pale yellow to brown; prickles 1–14, present on midvein and lateral veins, or on midvein only; stellate hairs very dense, 0–0.05 mm apart, 0.3–0.45 mm diameter, stalks 0–0.1 mm long; lateral rays 7–8, porrect; central ray 0.5–1 times as long as laterals, not gland-tipped; simple hairs absent. Inflorescence leaf-opposed or supra-axillary, unbranched or 2-branched; common peduncle 0–30 mm long; rachis 15–40 mm long, prickles absent or occasionally present; 6–15-flowered, with all flowers bisexual, 5-merous; pedicels at anthesis 9–13 mm long, 0.65–1.1 mm thick, same thickness throughout, prickles absent. Calyx tube at anthesis 2.5–3.5 mm long; calyx lobes at anthesis deltate to rostrate, 0.5–2(–5) mm long; calyx prickles absent; calyx stellae very dense, yellow, brown or rusty, 0.3–0.4 mm across, stalks 0–0.1 mm long, lateral rays 7–8, central ray 0.7–1.3 times as long as laterals, not gland-tipped, simple hairs absent. Corolla light purple to purple, *c.* 12 mm long, shallowly lobed, inner surface with sparse to dense stellate hairs; anthers 4.1–4.7 mm long; filaments 1.3–2 mm long; ovary with dense stellate hairs; functional style 6.5–7 mm long, protruding between anthers, with dense stellate hairs on basal 1 mm, otherwise glabrous. Fruiting calyx lobes less than or more than half length of mature fruit, prickles absent; mature fruits 2–3 per inflorescence, globose, 12–18 mm diameter, yellow (*van Royen 10901*) or orange (*Risdale NGF36960*) at maturity; pedicels 20–30 mm long, thicker towards apex, 1.1–1.6 mm thick at midpoint. Seeds not seen. **Figs. 7, 8.**

***Additional specimens examined*: Papua New Guinea.** Central Province: SE slope to Mt Victoria Range, Jul 1974, *Croft & Larivita LAE61684* (A, BRI, CANB); Trail to Mt Albert Edward, subdistrict Goilala, Jul 1969, *Foreman & Wardle NGF45531* (BRI, CANB, L); Murray Pass, Goilala sub-district, Aug 1968, *Ridsdale NGF36960* (A, BRI, CANB, L); Road from Woitape to Kosipi, Uriko, Jan 1965, *van Royen NGF20224* (BRI, CANB, L); Mt Victoria area, track from Koma Creek to the Rock Pile, SE of Mt Service, May 1976, *van Royen 10901* (CANB, L).

***Distribution and habitat*:** *Solanum invictum* is confined to a relatively small area on and adjacent to the main dividing range to the north and north-east of Port Moresby (**Map 3**). It inhabits disturbed sites in or adjacent to montane rainforest at altitudes between 2000 and 3000 metres. Associated species include *Nothofagus* sp. and *Papuacedrus papuana* (F.Muell.) H.L.Li.

***Phenology*:** Flowers and fruits have been recorded in January, May, July and August.

***Notes*:** The specimens of *Solanum invictum* cited above were included by Symon (1985) in *S. trichostylum*. It differs from *S. trichostylum* by the branchlet prickles 1–6 mm long (1–2

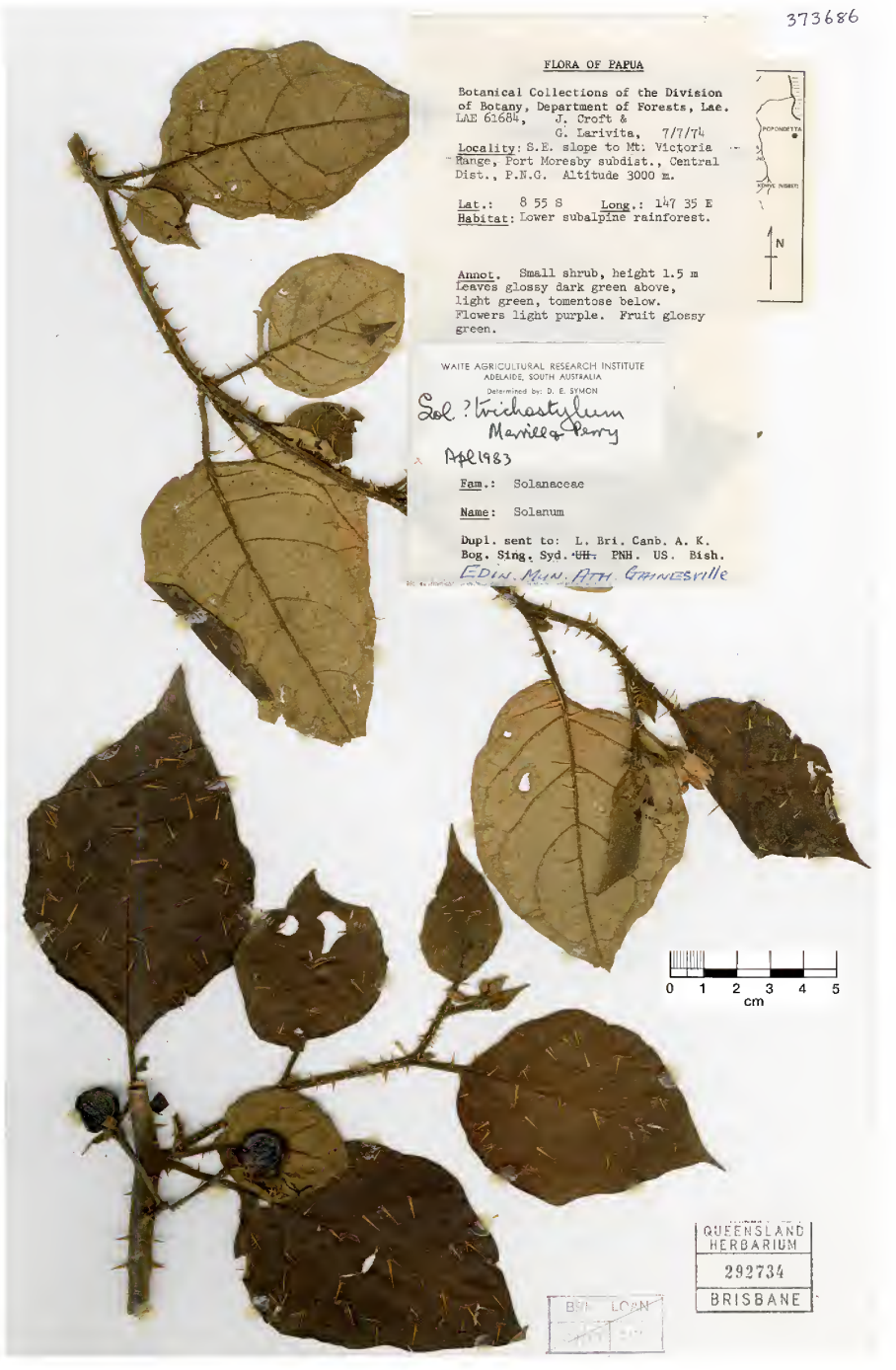

Fig. 7. Holotype of ***Solanum invictum*** (*Croft & Larivita LAE61684*, BRI).

Fig. 8. Section of branchlet of ***Solanum invictum*** (*Croft & Larivita LAE61684*, BRI).

mm long for *S. trichostylum*), the more numerous (3–60) prickles on the upper leaf surface (0–6 for *S. trichostylum*), the glabrous or very sparsely hairy upper leaf surface (sparsely hairy for *S. trichostylum*), the very densely hairy lower leaf surface (moderately dense hairs for *S. trichostylum*), and the style with dense stellate hairs only at the base (stellate hairs almost throughout or with tiny glandular hairs only for *S. trichostylum*).

***Etymology*:** The specific epithet is from the Latin *invictus*, meaning 'unconquered, strong'. This species has the appearance of being a strong and sturdy shrub.

16. Solanum leptacanthum Merr. & L.M.Perry, *J. Arnold Arb.* 30: 45 (1949). **Type:** Papua New Guinea. Central Province: Diene, Ononge road, April 1933, *L.J. Brass 3814* (holo: A; iso: BRI, L, NY).

For a description and discussion, see Symon (1985).

17. Solanum malignum A.R.Bean **sp. nov.** With affinity to *S. rivicola*, but differing by its erect shrubby habit; the much longer (and invariably straight) prickles on the branchlets; the stellate hairs of the branchlets with broad conical stalks; the fewer prickles on the upper leaf surface and the 5–7-flowered inflorescences with pedicels 0.4–0.6 mm thick. **Typus:** Papua New Guinea. Southern Highlands Province: SE slopes of Mt Giluwe, IARO logging area, 26 June 1977, *D.E. Symon 10696 & P. Katik* (holo: AD; iso: CANB, L).

Illustration: Symon (1985: 121), as *S. rivicola*.

Erect shrub 0.5–1 m high. Sympodia bifoliate, disjunct. Branchlets dark brown; prickles 14–28 per dm, straight, broad-based, 5–12 mm long, 1.5–4 times longer than wide, glabrous throughout or with sparse stellate hairs attached; branchlet stellate hairs frequent to dense, 0.4–0.65 mm diameter, stalks broad, conical, 0–0.6 mm long; lateral rays 7–8, porrect; central ray 0.3–0.7 times as long as laterals, not gland-tipped; simple hairs absent. Adult leaves elliptical, entire or shallowly lobed, with 2 pairs of acute lobes, lobing index 1–1.2; lamina 5.1–8.1 cm long, 2–5 cm wide, 1.6–2.5 times longer than broad; apex acute to acuminate, base cuneate, oblique part 0–2 mm long, obliqueness index 0–3 percent; petioles 0.9–2.8 cm long, 15–35% length of lamina, prickles present. Upper leaf surface green; prickles present on midvein and lateral veins, 7–13, straight, broad-based, 4–13 mm long; stellate hairs distributed throughout, hairs very sparse to sparse, 0.35–0.6 mm apart, 0.2–0.35 mm across, sessile, lateral rays 5–8, porrect; central ray 0.1–0.6 times as long as laterals, not gland-tipped; simple hairs absent. Lower leaf surface green; prickles 4–12, present on midvein and lateral veins, or sometimes on midvein only; stellate hairs very sparse to sparse, 0.25–0.5 mm apart, 0.2–0.4 mm diameter, stalks 0–0.05 mm long; lateral rays 4–8, porrect; central ray 0.1–0.8 times as long as laterals, not gland-tipped; simple hairs absent. Inflorescence supra-axillary, unbranched; common peduncle absent or present, 0–3 mm long; rachis present, 2–7 mm long; 5–7-flowered, with all flowers bisexual, 4- or 5-merous; pedicels at anthesis 17–24 mm long, 0.4–0.6 mm thick, thickened towards apex, prickles present or absent. Calyx tube at anthesis 1–1.5

mm long; calyx lobes at anthesis rostrate, 1–1.5 mm long; calyx prickles almost always absent, rarely 1 present; calyx stellae dense, yellow or purple, 0.3–0.45 mm across, stalks 0–0.05 mm long, lateral rays 6–8, central ray 0.1–0.5 times as long as laterals, not gland-tipped, simple hairs absent. Corolla pale lavender, 10–14 mm long, deeply lobed, inner surface with sparse stellate hairs; anthers 3.8–4.7 mm long; filaments 1.4–1.8 mm long; ovary glabrous, functional style 6–7.5 mm long, protruding between anthers, glabrous. Fruiting calyx lobes less than half length of mature fruit, prickles absent; mature fruits 4–6 per inflorescence, globose, diameter unknown, bright red (*Symon 10698 & Katik*) at maturity; pedicels 27–28 mm long, thicker towards apex, 0.5–0.6 mm thick at midpoint. Seeds pale yellow, 2.9–3.2 mm long. **Figs. 9, 10.**

***Additional specimens examined*: Papua New Guinea.** Southern Highlands Province: SE slopes of Mt Giluwe, IARO logging area, Jun 1977, *Symon 10696 & Katik* (AD); SE slopes of Mt Giluwe, Jun 1977, *Symon 10698 & Katik* (AD, CANB, L); Mt Giluwe, Munie timber track, Jun 1984, *Symon 13885* (AD, L).

***Distribution and habitat*:** *Solanum malignum* is known only from the vicinity of Mt Giluwe, to the south-west of Mount Hagen (**Map 1**), at altitudes from 2450 m to 2800 m. It reportedly grows in disturbed areas in logged *Nothofagus pullei* Steenis forest.

***Phenology*:** Flowers and fruits are recorded for June.

***Notes*:** The specimens of *Solanum malignum* cited above were included by Symon (1985) in *S. rivicola*. It differs from *S. rivicola* by its erect shrubby habit; the 5–12 mm long (and invariably straight) prickles on the branchlets (branchlet prickles strongly recurved, 1.5–4 mm long for *S. rivicola*); the stellate hairs of the branchlets with broad conical stalks to 0.6 mm long (slender stalks to 0.1 mm long for *S. rivicola*); the 7–13 prickles on the upper leaf surface (14–38 prickles for *S. rivicola*) and the 5–7-flowered inflorescences with pedicels 0.4–0.6 mm thick (1–2 flowered, pedicels 0.15–0.25 mm thick for *S. rivicola*).

***Etymology*:** The specific epithet is from the Latin *malignus*, meaning 'of evil nature'. This refers to the many large prickles on the stems and leaves.

18. Solanum missimense Symon, *J. Adelaide Bot. Gard.* 8: 113 (1985). **Type:** Papua New Guinea. Morobe Province: Lower to middle slopes of Mt Missim, 2 June 1984, *D. Symon 13838 & A. Kairo* (holo: AD; iso: BRI, CANB, K, L; LAE, MO *n.v.*).

For a description and discussion, see Symon (1985).

19. Solanum nolense Symon, *J. Adelaide Bot. Gard.* 8: 115 (1985). **Type:** Papua New Guinea. Southern Highlands Province: Between Nol and Mendi, 6 km from Nol, 24 June 1977, *D. Symon 10688 & P. Katik* (holo: AD; iso: CANB, K, L; LAE *n.v.*).

For a description and discussion, see Symon (1985).

20. Solanum oomsis A.R.Bean **sp. nov.** With affinity to *S. discolor*, but differing by the larger and broader leaves, the often branched inflorescences, the longer corolla, the smaller fruits and seeds, the moderately dense indumentum of the lower leaf surface, and the geminate leaves of the sympodia. **Typus:** Papua New Guinea. Morobe Province: Oomsis Logging Area near Lae, 15 March 1960, *E.E. Henty NGF11957* (holo: BRI; iso: CANB, L; LAE *n.v.*).

Erect perennial shrub, 3–3.5 m high. Sympodia bifoliate, geminate. Branchlets brown; prickles absent; branchlet stellate hairs dense to very dense, 0.25–0.4 mm diameter, stalks 0–0.1 mm long, slender, cylindrical; lateral rays 6–8, porrect; central ray 0.3–4 times as long as laterals, not gland-tipped; simple hairs absent. Adult leaves broadly ovate to elliptical, entire or with shallow lobes, lobing index 1–1.2; leaves 14.1–20 cm long, 5.7–10.5 cm wide, 1.8–2.5 times longer than broad; apex acute, base cuneate to obtuse, oblique part 2.5–7 mm long, obliqueness index 2–4 percent; petioles 1–3 cm long, 7–16% length of lamina, prickles absent. Upper leaf surface green; prickles absent; stellate hairs absent or confined to major veins; simple hairs absent. Lower leaf surface green to grey-green; prickles absent; stellate hairs

Fig. 9. Holotype of ***Solanum malignum*** (*Symon 10696 & Katik*, AD).

Fig. 10. Inflorescence of ***Solanum malignum*** (*Symon 10696 & Katik*, AD).

moderately dense, 0.2–0.3 mm apart, 0.3–0.5 mm diameter, stalks absent; lateral rays 7–8, porrect; central ray 0.2–1.5 times as long as laterals, not gland-tipped; simple hairs absent. Inflorescence leaf-opposed, unbranched or 2-branched; common peduncle 3–24 mm long; rachis 24–61 mm long, prickles absent; 14–35-flowered, with some flowers male, 5-merous; pedicels at anthesis 5–9 mm long, *c.* 0.3 mm thick, same thickness throughout, prickles absent. Calyx tube at anthesis 1–1.5 mm long; calyx lobes at anthesis elliptic or deltate, 0.5–1 mm long; calyx prickles absent; calyx stellae moderately dense to dense, white, 0.2–0.35 mm across, stalks 0–0.1 mm long, lateral rays 5–8, central ray 0.3–2 times as long as laterals, not gland-tipped, simple hairs absent. Corolla pale mauve to purple, 8–10 mm long, deeply lobed, inner surface glabrous; anthers 4.3–5.5 mm long; filaments 0.5–1.7 mm long; ovary glabrous; functional style *c.* 7.5 mm long, protruding between anthers, glabrous. Fruiting calyx lobes less than half length of mature fruit, prickles absent; mature fruits 1–3 per inflorescence, globose, *c.* 8 mm diameter, bright red at maturity; pedicels 20–23 mm long, thicker towards apex, 0.6–0.9 mm thick at midpoint. Seeds pale yellow, 2.2–2.6 mm long. **Figs. 11, 12.**

***Additional specimens examined*:** Papua New Guinea. Morobe Province: Oomsis Logging Area near Lae, Mar 1960, *Henty NGF11957* (BRI, CANB, L). Madang Province: Between villages of Dimir and Basken in the hills behind Dylup plantation, *c.* 50 miles [80 km] N of Madang, Oct 1958, *Pullen 1207* (CANB, L).

***Distribution and habitat*:** *Solanum oomsis* is known from two widely separated sites close to the north-east coast of Papua New Guinea (**Map 1**). Altitude ranges from 60 to 250 metres. It occurs in "garden regrowth" or in logged forest.

***Phenology*:** Flowers and fruits have been collected in March and October.

Notes: The specimens of *Solanum oomsis* cited above were included by Symon (1985) in *S. turraeifolium* (= *S. discolor*). *S. oomsis* has unarmed stems, broadly elliptic slightly-lobed leaves, glabrous upper leaf surfaces, moderately dense lower surfaces, unbranched or 2-branched inflorescences, and red fruits *c.* 8 mm diameter. It differs from *S. discolor* by the larger and broader leaves, the often branched inflorescences, the longer corolla, the smaller fruits and seeds, the moderately dense indumentum of the lower leaf surface, and the geminate leaves of the sympodia. The collection from Madang province differs from the type by the stellate hairs having a shorter central ray, the shorter petioles and the somewhat narrower laminae.

***Etymology*:** The specific epithet refers to the Oomsis Logging Area. It is used as a noun in apposition.

21. Solanum ortivum A.R.Bean **sp. nov.** With affinity to *S. anfractum*, but differing by the greater number of flowers per inflorescence and the much longer rachis, the very short central ray of the stellate hairs, the shorter anthers, and the sparse indumentum on the lower leaf surface. **Typus:** Papua New Guinea. Madang Province: Sewe, Saidor subdistrict, 10 August 1964, *C.D. Sayers NGF 19832* (holo: BRI; iso: LAE *n.v.*).

Erect perennial shrub, *c.* 3 m high. Sympodia bifoliate, geminate. Branchlets brown; prickles 35–52 per dm, straight, broad-based, 0.2–1.2 mm long, 1–2 times longer than wide, with dense stellate hairs at base; branchlet

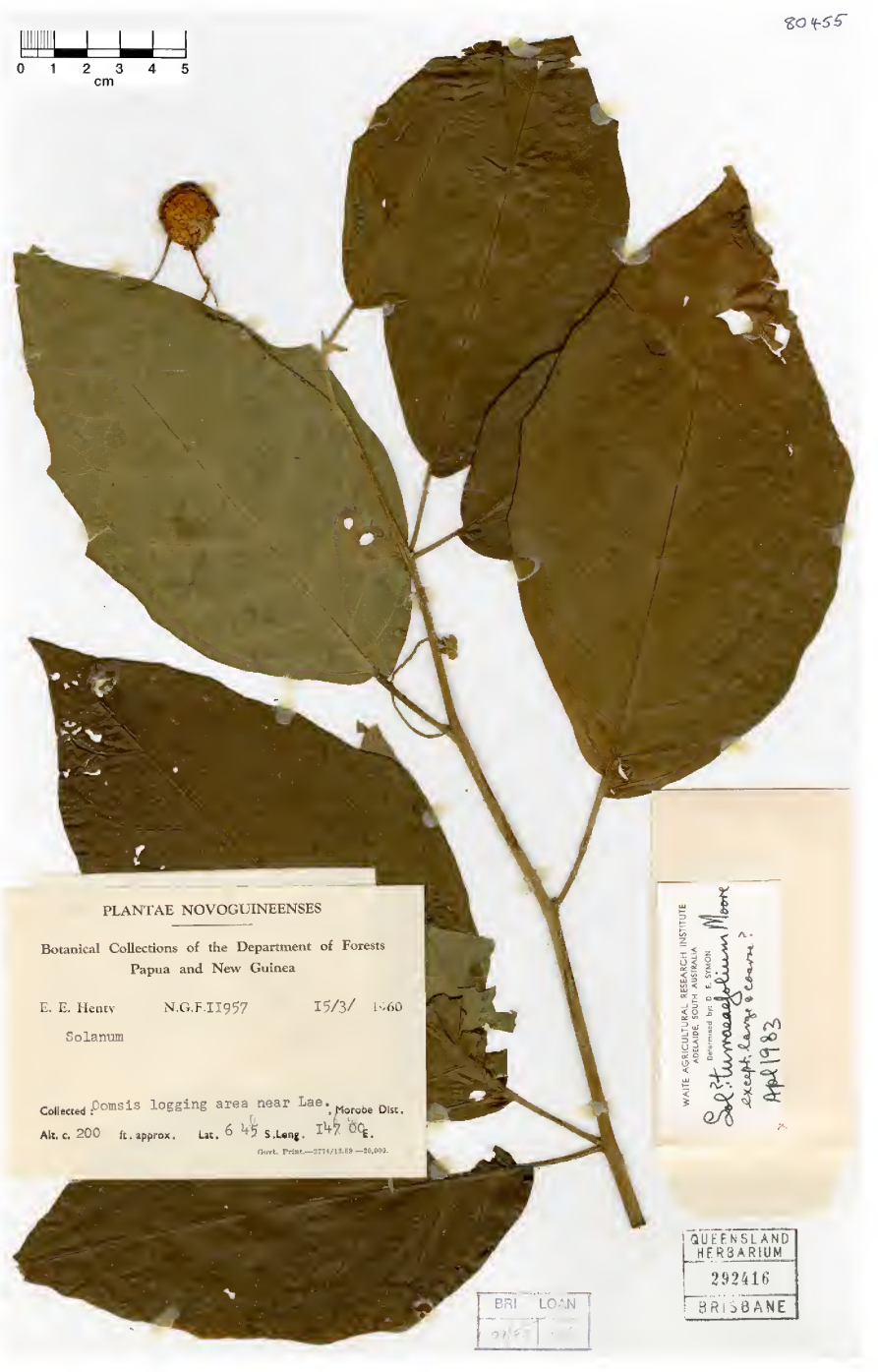

Fig. 11. Holotype of ***Solanum oomsis*** (*Henty NGF11957*, BRI).

Fig. 12. Branched inflorescence of ***Solanum oomsis*** (*Henty NGF11957*, CANB).

stellate hairs frequent to dense, 0.15–0.25 mm diameter, stalks absent; lateral rays 6–8, porrect; central ray 0.4–0.7 times as long as laterals, not gland-tipped. Adult leaves elliptical, entire, 5–7.7 cm long, 2.1–3.1 cm wide, 2.2–2.5 times longer than broad; apex acute to acuminate, base cuneate, oblique part 0–6 mm long, obliqueness index 0–8 percent; petioles 0.45–0.9 cm long, 9–16% length of lamina, prickles absent. Upper leaf surface dark green; prickles absent; stellate hairs distributed throughout, very sparsely distributed, 0.25–0.6 mm apart, 0.1–0.15 mm across, sessile, lateral rays 4–8, porrect; central ray 0.1–0.4 times as long as laterals, not gland-tipped; simple hairs absent. Lower leaf surface greenish-white; prickles absent; stellate hairs sparse, 0.2–0.4 mm apart, 0.2–0.3 mm diameter, stalks absent; lateral rays 4–8, porrect; central ray 0–0.2 times as long as laterals, not gland-tipped; simple hairs absent. Inflorescence leaf-opposed, unbranched; common peduncle 15–31 mm long; rachis 30–63 mm long, prickles absent; 8–20-flowered, 4–5-merous; pedicels at anthesis *c.* 15 mm long and 0.3 mm thick, same thickness throughout, prickles absent. Calyx tube at anthesis *c.* 1.5 mm long; calyx lobes at anthesis elliptic, *c.* 0.5 mm long; calyx prickles absent; calyx stellae moderately dense to dense, white, 0.2–0.3 mm across, stalks absent, lateral rays 5–8, central ray 0.1–0.4 times as long as laterals, not gland-tipped, simple hairs absent. Corolla purple, *c.* 8 mm long, deeply lobed, inner surface with sparse stellate hairs, mainly near lobe apices; anthers 2.4–3 mm long; functional style *c.* 5 mm long, protruding between anthers, glabrous. Fruiting calyx lobes less than or more than half length of mature fruit, prickles absent; fruits 1–2 per inflorescence, globose, diameter and colour at maturity unknown; pedicels of immature fruits 11–15 mm long, cylindrical or thicker towards apex. Seeds not seen. **Fig. 13, 14.**

***Additional specimens examined*:** Known only from the type.

***Distribution and habitat*:** *Solanum ortivum* has been collected so far, only at Sewe, in Madang province (**Map 1**), at an altitude of 2300 metres. It inhabits rainforest.

***Phenology*:** Flowers and immature fruits recorded for August.

***Notes*:** The type of *Solanum ortivum* was included by Symon (1985) in *S. anfractum*. It shares with *S. anfractum* the geminate leaves of the sympodia, the rather zig-zag stems, and the very sparse indumentum on the upper leaf surface. However, *S. ortivum* differs in several ways from *S. anfractum*; the rachis of the inflorescence 30–63 mm long (1–12 mm long for *S. anfractum*), the 8–20 flowers per inflorescence (1–3 flowered for *S. anfractum*); the stellate hairs of the upper leaf surface 0.1–0.15 mm diameter (0.25–0.4 mm diameter for *S. anfractum*); the anthers 2.4–3 mm long (5–7.5 mm long for *S. anfractum*), and the frequent very short branchlet prickles with a stellate-hairy base (branchlet prickles glabrous for *S. anfractum*).

***Etymology*:** From the Latin *ortivus* "of rising", or "the eastern or dawn side". This is given in reference to the occurrence of this species to the east of the Ramu Highway, where no collections of *S. anfractum* have been made.

22. Solanum papuanum Symon, *J. Adelaide Bot. Gard.* 8: 116 (1985). **Type:** Papua New Guinea. Eastern Highlands Province: Marafunga Logging Area, upper Asaro valley, near Goroka, 7 September 1961, *J.S. Womersley & H.O. Sleumer NGF13992* (holo: LAE *n.v.*; iso: BRI, K, L.).

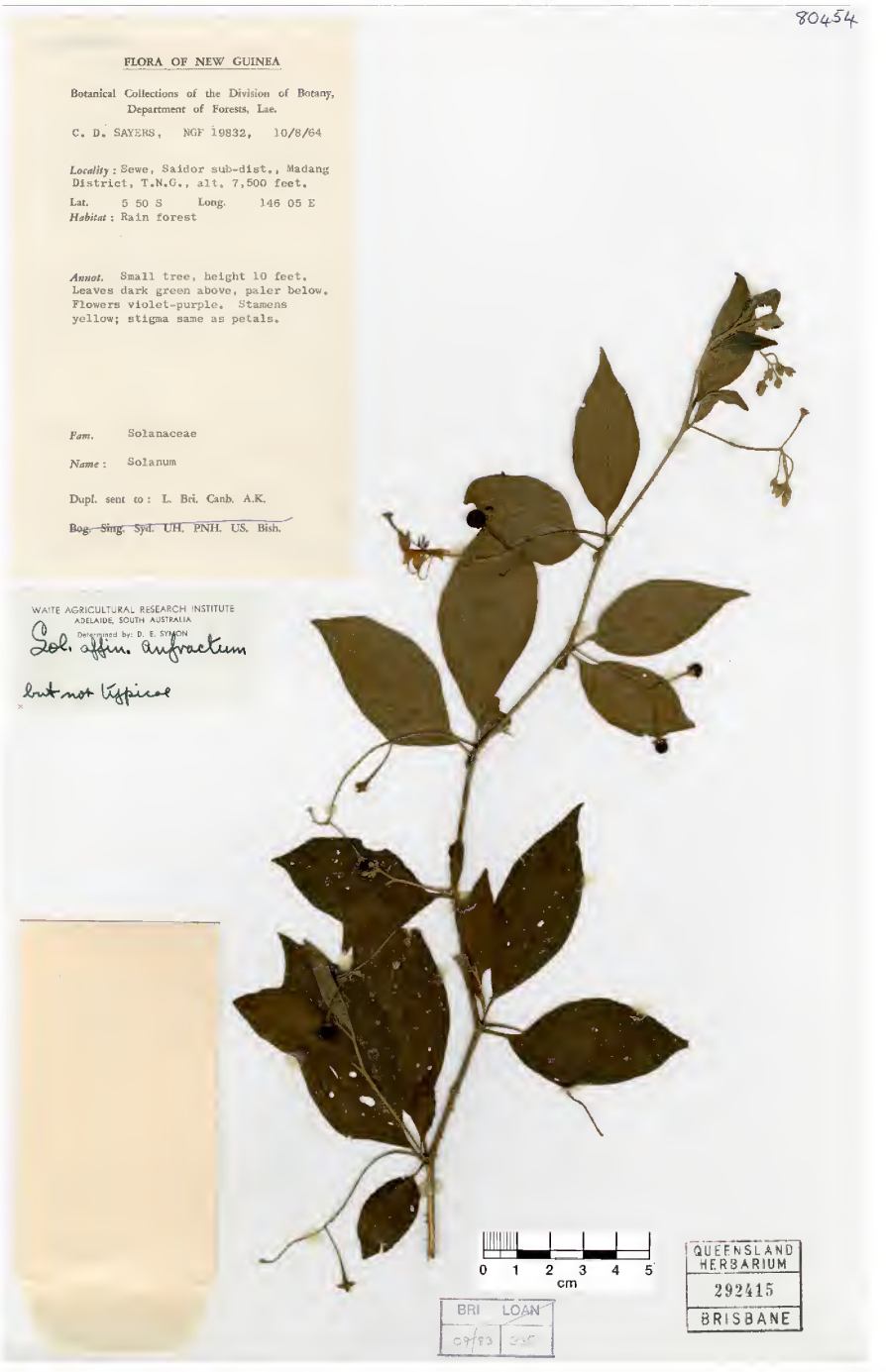

Fig. 13. Holotype of ***Solanum ortivum*** (*Sayers NGF 19832*, BRI).

Fig. 14. Inflorescence of ***Solanum ortivum*** (*Sayers NGF 19832*, BRI).

Erect perennial shrub, 1–1.2 m high. Sympodia bifoliate, geminate. Branchlets brown to rusty; prickles 14–20 per dm, straight, broad-based, 0.5–5 mm long, 1–1.5 times longer than wide, with stellate hairs throughout lower part; branchlet stellate hairs dense to very dense, 0.6–1.0 mm diameter, stalks 0–0.5 mm long; lateral rays 6–9, porrect; central ray 0–0.2 times as long as laterals, not gland-tipped; simple hairs absent. Adult leaves ovate, broadly ovate or elliptical, entire, 6.4–15 cm long, 3–6 cm wide, 1.9–2.5 times longer than broad; apex acute, base cuneate, oblique part 0–6 mm long, obliqueness index 0–4 percent; petioles 1.2–2.5 cm long, 16–19% length of lamina, prickles absent or present. Upper leaf surface green; prickles absent or sometimes present on midvein only, 0–7, straight, broad-based, 2–8 mm long; stellate hairs distributed throughout, moderately dense to dense, 0.2–0.4 mm apart, 0.3–0.8 mm across, stalks 0–0.3 mm long, lateral rays 1–7, ascending; central ray 0.2–0.5 times as long as laterals, not gland-tipped; simple hairs usually present, 0.1–0.3 mm long, 0.1–0.5 mm apart. Lower leaf surface yellow to rusty; prickles absent or rarely present, 0–2, confined to midrib; stellate hairs very dense, 0–0.05 mm apart, 0.45–0.6 mm diameter, stalks 0–0.4 mm long; lateral rays 7–8, porrect; central ray 0.1–0.2 times as long as laterals, not gland-tipped; simple hairs absent. Inflorescence supra-axillary, unbranched; common peduncle 0–6 mm long; rachis 3–27(–53) mm long, prickles absent or present; 8–16-flowered, with most flowers bisexual, 5-merous; pedicels at anthesis 8–9 mm long, 0.6–0.8 mm thick, same thickness throughout, prickles absent. Calyx tube at anthesis 1.5–2 mm long; calyx lobes at anthesis elliptic to deltate, 0.5–1 mm long; calyx prickles absent; calyx stellae very dense, rusty, 0.35–0.5 mm across, stalks 0–0.25 mm long, lateral rays 6–8, central ray 0.1–0.3 times as long as laterals, not gland-tipped, simple hairs absent. Corolla mauve, 11–12 mm long, shallowly lobed, inner surface with very sparse stellate hairs; anthers 2.5–3.8 mm long; filaments *c.* 1.2 mm long; ovary glabrous; functional style *c.* 6.5 mm long, protruding between anthers, glabrous. Fruiting calyx lobes less than half length of mature fruit, prickles absent; mature fruits 3–8 per inflorescence, globose, 9–14 mm diameter, black (*McKee & Floyd 6356*) or red (*Croft LAE61900*) at maturity; pedicels 17–23 mm long, thicker towards apex, *c.* 1.1 mm thick at midpoint.

***Additional specimens examined*:** Papua New Guinea. Morobe Province: Katom River field site, via Yawan village, Sarawagel Range, Huon peninsula, Aug 2004, *Jensen NG943 & Fazang* (BRI). Central Province: SE slope to Lake Myola No. 2, Sep 1973, *Croft & Lelean NGF34817* (BRI, L); E side lake Myola No. 1, Jul 1974, *Croft LAE61900* (BRI). Eastern Highlands Province: Mt Wilhelm, E slopes, Jul 1959, *Brass 30725* (L, NY); Daulo – Chuave Road, Nov 1954, *McKee & Floyd 6356* (BRI, L); Fatima River, Goroka subdistrict, May 1965, *Millar NGF22538* (BRI, L); Fatima River, Marafunga, Goroka subdistrict, Nov 1968, *Millar NGF40709* (BRI, L); Daulo camp, Asaro-Mairifutica divide, Aug 1957, *Pullen 397* (L). Southern Highlands Province: Between Kagoba and Border gate, subdistrict Mendi, Nov 1973, *Womersley NGF46444* (BRI, L).

***Distribution and habitat*:** *Solanum papuanum* is widespread in Papua New Guinea, but known from just a few areas (**Map 3**), at altitudes ranging from 1800 to 2600 metres. It grows in open areas along roadside adjacent to submontane rainforest, or in regrowth from logging.

***Phenology*:** Flowers are recorded for May, July, August, September and November; fruits in July, September and November.

***Notes*:** *Solanum papuanum* can be distinguished by the very dense indumentum on the lower leaf surfaces, and the stellate hairs on the upper leaf surfaces having ascending lateral rays, with some hairs reduced to a simple form. Some of the specimens cited under *S. papuanum* by Symon (1985) are here referred to *S. trichostylum* or *S. arachnoides*.

The collection *Croft LAE61900* is atypical because of the more prominent venation on the underside of the leaves, the large fruits and the long rachis of the inflorescence. *Millar NGF40709* is also atypical because of its small leaves and quite slender prickles on the branchlets and leaves.

23. Solanum petilum A.R.Bean **sp. nov.** With affinity to *S. trichostylum* but differing by the very dense tomentum on the lower leaf surface, the 4-merous flowers, the stellate hairs of the lower leaf surface with 8–14 lateral rays, and the slender prickles on the upper leaf surface and branchlets. **Typus:** Papua New Guinea. Central Province: W slopes of Mt Kenive (Nisbet), 26 July 1974, *J.R. Croft LAE65050* (holo: BRI; iso: CANB, L).

Erect perennial shrub c. 1.5 m high. Sympodia bifoliate, geminate or disjunct. Branchlets grey to yellow; prickles 4–28 per dm, straight, needle-like or broad-based, 0.5–3.5 mm long, 4–8 times longer than wide, glabrous or with stellate hairs throughout lower part; branchlet stellate hairs very dense, 0.25–0.6 mm diameter, stalks 0–0.1 mm long; lateral rays 8–10, porrect; central ray 0.5–1 times as long as laterals, not gland-tipped; simple hairs absent, simple hairs absent. Adult leaves ovate to elliptical, entire, 7.2–9.4 cm long, 2.2–3.5 cm wide, 2.3–3.3 times longer than broad; apex acute, base cuneate, oblique part 0–2 mm long, obliqueness index 0–3 percent; petioles 1.1–2.2 cm long, 15–25% length of lamina, prickles absent. Upper leaf surface green; prickles present on midvein and lateral veins or on midvein only, 1–12, straight, needle-like, 1–5 mm long; stellate hairs distributed throughout, sparse to moderately dense, 0.2–0.5 mm apart, 0.35–0.5 mm across, sessile, lateral rays 4–8, porrect; central ray 1–2 times as long as laterals, not gland-tipped; simple hairs absent. Lower leaf surface yellowish; prickles absent; stellate hairs very dense, 0–0.05 mm apart, 0.25–0.45 mm diameter, stalks 0–0.1 mm long; lateral rays 8–14, porrect; central ray 0.5–1 times as long as laterals, not gland-tipped; simple hairs absent. Inflorescence supra-axillary, unbranched; common peduncle 0–2 mm long; rachis 7–19 mm long, prickles absent; 4–13-flowered, flowers bisexual, 4-merous; pedicels at anthesis 9–13 mm long, 0.8–0.9 mm thick, same thickness throughout, prickles absent. Calyx tube at anthesis 1.5–2 mm long; calyx lobes at anthesis elliptic, 1.5–2.5 mm long; calyx prickles absent; calyx stellae very dense, yellow, 0.25–0.35 mm across, stalks 0–0.1 mm long, lateral rays 8–10, central ray 0.5–1 times as long as laterals, not gland-tipped, simple hairs absent. Corolla purple, *c.* 11 mm long, shallowly lobed, inner surface with sparse stellate hairs; anthers 2.6–3.2 mm long; filaments 1.5–2 mm long; ovary with scattered tiny glandular hairs; functional style *c.* 5.5 mm long, protruding between anthers, with scattered tiny glandular hairs on lower one-third, otherwise glabrous. Fruiting calyx lobes less than half length of fruit, prickles absent; mature fruits and seeds not seen. **Figs. 15, 16, 17, 18.**

***Additional specimens examined*:** Known only from the type.

***Distribution and habitat*:** *Solanum petilum* is known only from one location near the boundary of Central and Northern provinces (**Map 2**), at an altitude of 3000 metres. It grows in submontane rainforest.

***Phenology*:** Flowers and immature fruits are recorded for July.

***Notes*:** The type specimens of *Solanum petilum* were included by Symon (1985) under *S. trichostylum*. *S. petilum* differs from that species by the very dense tomentum on the lower leaf surface (moderately dense for *S. trichostylum*), the 4-merous flowers (5-merous for *S. trichostylum*), the stellate hairs of the lower leaf surface with 8–14 lateral rays (6–8 lateral rays for *S. trichostylum*), and the slender prickles on the upper leaf surface

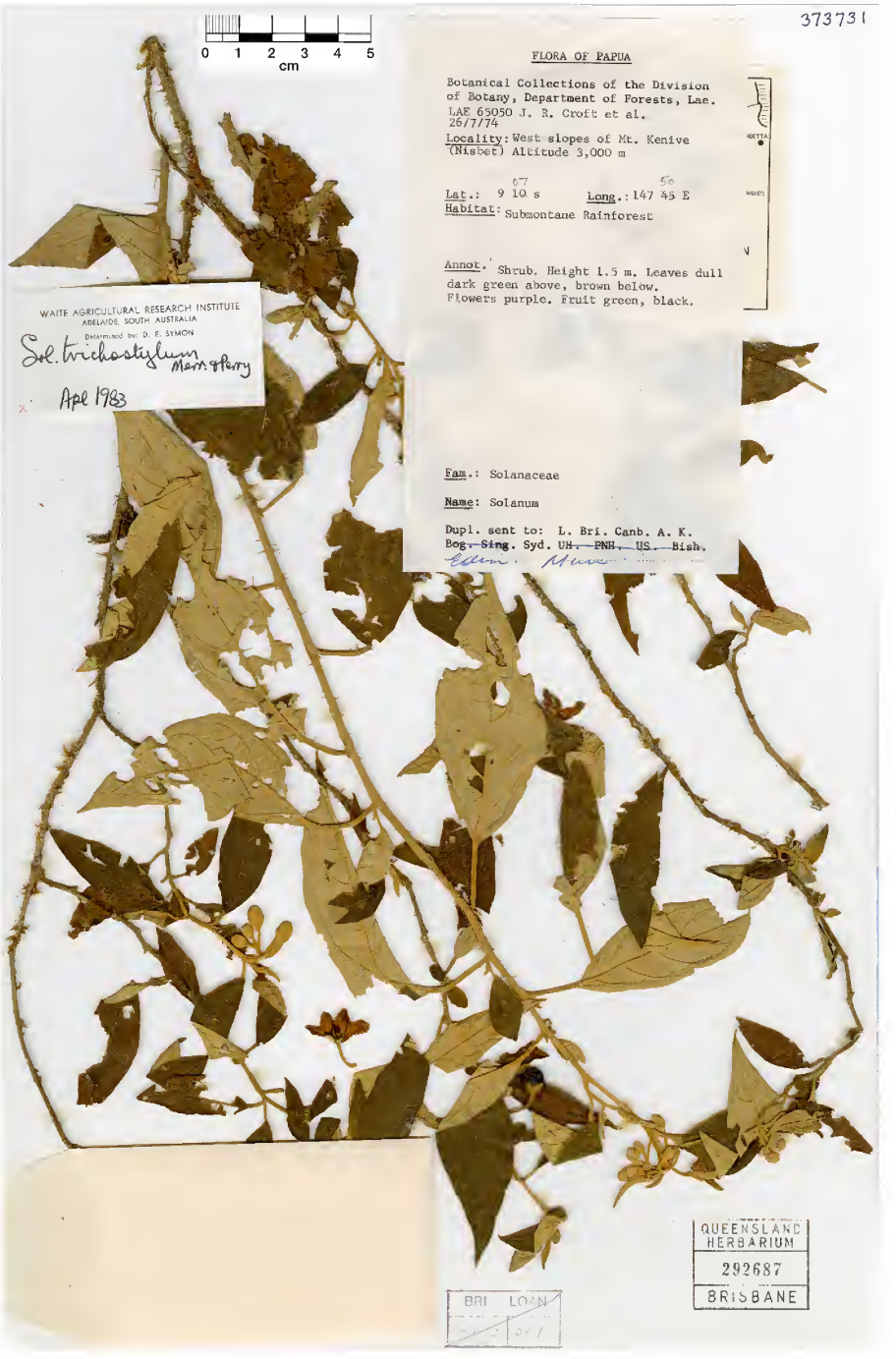

Fig. 15. Holotype of ***Solanum petilum*** (*Croft LAE65050*, BRI).

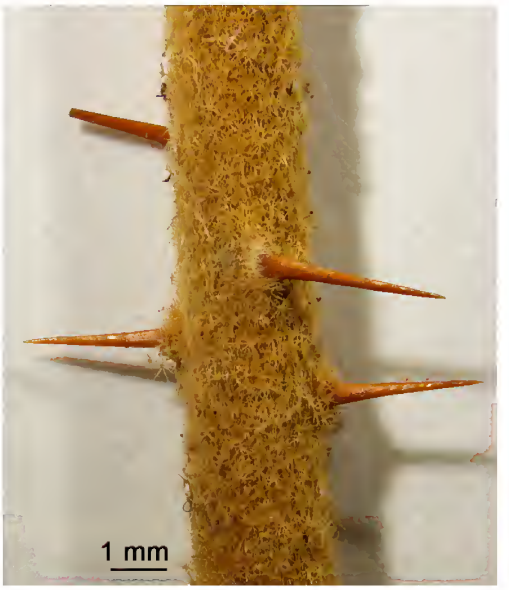

Fig. 16. Section of branchlet showing slender prickles of ***Solanum petilum*** (*Croft LAE65050*, BRI).

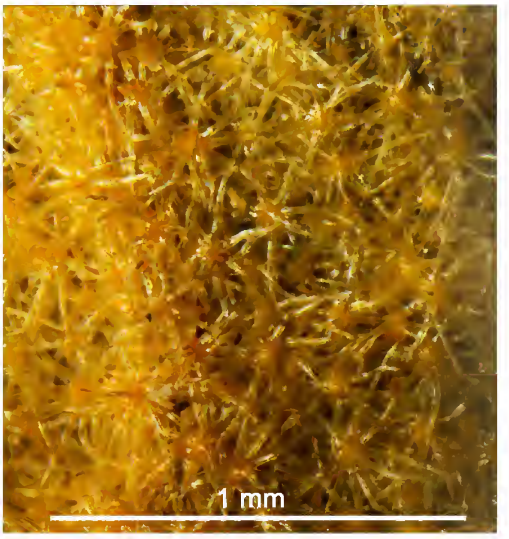

Fig. 17. Underside of leaf of ***Solanum petilum***, showing multi-rayed stellate hairs (*Croft LAE65050*, BRI).

Fig. 18. Opened out flower of ***Solanum petilum*** (*Croft LAE65050*, BRI).

and branchlets 3–8 times longer than broad (broad-based prickles, 1–2 times longer than broad for *S. trichostylum*).

The name of the mountain from which the type was collected now appears in the gazetteers as Mt Kanevi. All occurrences of *S. trichostylum* are disjunct from *S. petilum* by more than 90 km.

***Etymology*:** The specific epithet is from the Latin *petilus*, meaning 'slender, thin'. This refers to the slender prickles possessed by this species, in comparison with its relatives.

24. Solanum phoberum A.R.Bean **sp. nov.** With affinity to *S. rivicola*, but differing by the upright shrubby habit, the straight prickles of the branchlets, the fewer prickles on the upper leaf surface, the stellate hairs absent from lower leaf surface or confined to the veins, and the thicker pedicels. **Typus:** Papua New Guinea. Eastern Highlands Province. Mt Wilhelm, E slopes, high bank of Pengagl Creek, 9 July 1959, *L.J. Brass 30401* (holo: CANB; iso: L, NY).

Erect perennial shrub, up to 2.5 m high. Sympodia bifoliate, disjunct. Branchlets brown; prickles 14–30 per dm, straight, broad-based, 1–3.5 mm long, 2–3 times longer than wide, glabrous; branchlet

stellate hairs scattered to frequent, 0.3–0.4 mm diameter, stalks 0–0.1 mm long; lateral rays 6–8, porrect; central ray 0–0.3 times as long as laterals, not gland-tipped; simple hairs absent. Adult leaves broadly-ovate to elliptical, entire, 2.7–4.5 cm long, 1.7–2.7 cm wide, 1.6–2.1 times longer than broad; apex acute, base cuneate to obtuse, oblique part 0–1.5 mm long, obliqueness index 0–4 percent; petioles 0.6–0.8 cm long, 16–25% length of lamina, prickles present. Upper leaf surface dark green; prickles present on midvein and lateral veins, or along midvein only, 3–11, straight, broad-based, 2–9 mm long; stellate hairs confined to major veins or absent; simple hairs absent. Lower leaf surface green; prickles present on midvein and lateral veins, 5–8; stellate hairs absent or confined to major veins; simple hairs absent. Inflorescence supra-axillary, unbranched; common peduncle 0–2 mm long; rachis 1–3 mm long, prickles absent; 1(or 2)-flowered, with all flowers bisexual, 4-merous; pedicels at anthesis 13–23 mm long, *c.* 0.5 mm thick, same thickness throughout, prickles absent. Calyx tube at anthesis *c.* 2.0 mm long; calyx lobes at anthesis rostrate to attenuate, 2.5–3 mm long; calyx prickles absent or present, 0–3; calyx stellae sparse, yellow, 0.2–0.3 mm across, stalks absent, lateral rays 6–8, central ray 0.5–1 times as long as laterals, not gland-tipped, simple hairs absent. Corolla white above, purple below, 11–16 mm long, deeply lobed, inner surface glabrous; anthers 5.2–5.7 mm long; filaments 2.2–2.5 mm long; ovary glabrous; functional style 8–8.5 mm long, protruding between anthers, glabrous. Fruiting calyx lobes less than or more than half length of mature fruit, prickles absent or present, 0–3; fruits 1 per inflorescence, mature fruits not seen; pedicels 24–28 mm long, cylindrical or thicker towards apex, 0.6–0.9 mm thick at midpoint. Seeds not seen. **Figs. 19, 20.**

***Additional specimens examined*: Papua New Guinea.** Eastern Highlands Province: Komanemambino, Oct 1960, *Borgmann 246* (L); Mt Wilhelm, E slopes, high bank of Pengagl Creek, Jul 1959, *Brass 30401* (CANB, L, NY).

***Distribution and habitat*:** *Solanum phoberum* is only known from the vicinity of Mount Wilhelm, between 2770 and 2900 metres (**Map 4**). It reportedly grows on "forest edges".

***Phenology*:** Flowers and immature fruits recorded for July and October.

***Notes*:** Specimens cited above as *Solanum phoberum* were included by Symon (1985) under *S. rivicola*. *S. phoberum* can be distinguished by the many prickles on the leaves and branchlets, and the leaves glabrous or with a few scattered stellate hairs on the major veins. It is perhaps allied to *S. rivicola*, but differs by the upright shrubby habit, the straight prickles of the branchlets (strongly recurved for *S. rivicola*), the 3–11 prickles on the upper leaf surface (14–38 for *S. rivicola*), the stellate hairs absent from lower leaf surface or confined to the veins (hairs distributed throughout surface, very sparse to sparse for *S. rivicola*), and the thicker pedicels.

***Etymology*:** The epithet is a Latinised form of the Greek *phoberos*, meaning fearful, terrible or formidable. This is given in reference to the many sharp prickles on the stems and leaves.

25. Solanum pluriflorum A.R.Bean **sp. nov.** With affinity to *S. oomsis*, but differing by the presence of prickles on the branchlets and often on the leaves, the larger stellate hairs of the branchlets, the sparse to moderately dense stellate hairs on the upper leaf surface, the 4-merous flowers and the attenuate calyx lobes. **Typus:** Papua New Guinea. Eastern Highlands Province: Kassam Gap, 29 October 1959, *L.J. Brass 32309* (holo: CANB; iso: L, NY).

Erect perennial shrub, up to 2 m high. Sympodia bifoliate, geminate. Branchlets grey to brown; prickles prickles 5–13 per dm, straight, broad-based, 1–1.5 mm long, 1–1.5 times longer than wide, with scattered stellate hairs on lower part; branchlet stellate hairs dense, 0.4–0.55 mm diameter, stalks 0–0.2 mm long, slender, cylindrical; lateral rays 7–8, porrect; central ray 1.5–3 times as long as laterals, not gland-tipped; simple hairs absent. Adult leaves obovate to elliptical, with 1–3 pairs of shallow lobes, lobes obtuse, lobing index 1.2–1.5; leaves 6.9–11.5 cm long, 3.2–6.6 cm wide, 1.6–2.2 times longer than

Fig. 19. Holotype of ***Solanum phoberum*** (*Brass 30401*, CANB).

Fig. 20. Underside of leaf and flower bud of ***Solanum phoberum*** (*Brass 30401*, CANB).

broad; apex acuminate, base cuneate, oblique part 0–1.5 mm long, obliqueness index 0–2 percent; petioles 0.4–1.6 cm long, 7–14% length of lamina, prickles absent. Upper leaf surface green; prickles absent or present on midvein only, 0–1, straight and broad-based, each 1–2 mm long; stellate hairs distributed throughout, sparse to moderately dense, 0.25–0.5 mm apart, 0.4–0.5 mm diameter, stalks 0–0.1 mm long, slender, cylindrical; lateral rays 4–6, porrect; central ray 1.5–2.5 times as long as laterals, not gland tipped; simple hairs absent. Lower leaf surface yellow to yellowish-green; prickles absent or present on midvein only, 0–3; stellate hairs moderately dense, 0.2–0.3 mm apart, 0.4–0.5 mm diameter, stalks 0–0.2 mm long; lateral rays 7–8, porrect; central ray 1–2 times as long as laterals, not gland-tipped; simple hairs absent. Inflorescence leaf-opposed, 2- or 3-branched; common peduncle 22–47 mm long; rachis 28–62 mm long, prickles absent; 7–26-flowered, proportion of bisexual and male flowers unknown, 4-merous; pedicels at anthesis 11–12 mm long, *c.* 0.4 mm thick, same thickness throughout, prickles absent. Calyx tube at anthesis *c.* 2 mm long; calyx lobes at anthesis attenuate, 1.5–2 mm long; calyx prickles absent; calyx stellae dense to very dense, white, 0.3–0.4 mm across, stalks 0–0.1 mm long, lateral rays 6–8, central ray 1.5–3 times as long as laterals, not gland-tipped, simple hairs absent. Corolla lavender, 7–8 mm long, deeply lobed, inner surface glabrous, or with a few stellate hairs along midrib; anthers 4.5–4.9 mm long; filaments 1.4–1.7 mm long; ovary glabrous; functional style *c.* 6.5 mm long, protruding between anthers, glabrous. Fruiting calyx lobes more than half length of fruit, prickles absent; mature fruits not seen; pedicels 20–22 mm long, thicker towards apex, 0.5–0.6 mm thick at midpoint. Seeds not seen. **Figs. 21, 22.**

***Additional specimens examined*:** Known only from the type.

***Distribution and habitat*:** *Solanum pluriflorum* is known only from Kassam Gap, altitude 1460 metres (**Map 4**), where it occurs in young regrowth *Castanopsis*-oak forest.

***Phenology*:** Flowers and immature fruits recorded in October.

***Notes*:** The type specimen of *Solanum pluriflorum* was identified by Symon (1985) as *S. turraeifolium* (= *S. discolor*). It differs from *S. discolor* by the 2–3 branched inflorescences (unbranched for *S. discolor*), the leaves 1.6–2.2 times longer than broad (2.3–4.3 times for *S. discolor*), the stellate hairs of the branchlets 0.4–0.55 mm across (0.25–0.4 mm across for *S. discolor*), the sparse to moderately dense stellate hairs on the upper leaf surface (glabrous or confined to major veins in *S. discolor*), and the 4-merous flowers (5-merous in *S. discolor*).

S. pluriflorum is probably most closely related to *S. oomsis*, but differs by the presence of prickles on the branchlets and often on the leaves (prickles absent in *S. oomsis*), the stellate hairs of the branchlets 0.4–0.55 mm across (0.25–0.4 mm across for *S. oomsis*), the sparse to moderately dense stellate hairs on the upper leaf surface (glabrous or confined to major veins in *S. oomsis*), the 4-merous flowers (5-merous in *S. oomsis*) and the

Fig. 21. Holotype of ***Solanum pluriflorum*** (*Brass 32309*, CANB).

Fig. 22. Inflorescence of ***Solanum pluriflorum*** (*Brass 32309*, CANB).

attenuate calyx lobes (elliptic or deltate in *S. oomsis*).

***Etymology*:** The specific epithet is from the Latin *pluriflorus*, meaning many-flowered. This species has more flowers per inflorescence than most others in the *S. ferocissimum* group.

26. Solanum rivicola Symon, *J. Adelaide Bot. Gard.* 8: 118 (1985). **Type:** Papua New Guinea. Morobe Province: Road from Bulolo above Edie Creek, 30 May 1977, *D.E Symon 10638 & A. Kairo* (holo: AD; iso: L, MO, US; A, K, LAE, all *n.v.*).

Sprawling terrestrial ?vine to 0.3 m high. Sympodia bifoliate, disjunct. Branchlets brown; prickles 20–61 per dm, strongly recurved, broad-based, 1.5–4 mm long, 1–2 times longer than wide, glabrous throughout; branchlet stellate hairs scattered to frequent, 0.35–0.6 mm diameter, stalks 0–0.1 mm long; lateral rays 4–8, porrect; central ray 0.2–1 times as long as laterals, not gland-tipped; simple hairs absent. Adult leaves narrowly ovate to ovate or elliptical, entire, 3.5–6.8 cm long, 1.2–3.4 cm wide, 1.8–3.3 times longer than broad; apex acute to acuminate, base cuneate, oblique part 0–2 mm long, obliqueness index 0–5 percent; petioles 0.45–1.2 cm long, 13–18% length of lamina, prickles present. Upper leaf surface dark green; prickles present on midvein and lateral veins, 14–38, straight, broad-based, 1–8 mm long; stellate hairs confined to major veins or distributed throughout, hairs absent or very sparsely distributed, 0.8–1.8 mm apart, 0.3–0.45 mm across, sessile, lateral rays 4–8, porrect; central ray 0.8–1.5 times as long as laterals, not gland-tipped; simple hairs absent. Lower leaf surface pale green; prickles 5–13, present on midvein and lateral veins; stellate hairs very sparse to sparse, 0.3–1 mm apart, 0.3–0.4 mm diameter, stalks 0–0.05 mm long; lateral rays 4–8, porrect; central ray 0.5–1.6 times as long as laterals, not gland-tipped; simple hairs absent. Inflorescence supra-axillary, unbranched; common peduncle absent; rachis absent; 1–2-flowered, with all flowers bisexual, (4–)5-merous; pedicels at anthesis 12–19 mm long, 0.15–0.25 mm thick, same thickness throughout, prickles absent. Calyx tube at anthesis 1–2.5 mm long; calyx lobes at anthesis elliptic, 0.5–1 mm long; calyx prickles absent; calyx stellae sparse to moderately dense, yellow, 0.15–0.3 mm across, sessile, lateral rays 4–8, central ray 0.3–1 times as long as laterals, not gland-tipped, simple hairs absent. Corolla purple, 7–12 mm long, deeply lobed, inner surface glabrous or with very sparse stellate hairs; anthers 5–5.9 mm long; filaments 1.7–2 mm long; ovary glabrous; functional style 7–8 mm long, protruding between anthers, glabrous. Fruiting material not seen.

***Additional specimens examined*: Papua New Guinea.** Morobe Province: Bulldog Road, *c.* 20 km S of Wau, Jul 1977, *Fallen 534* (L); N slope of Mt Kaindi, Wau subprovince, Nov 1983, *Kerenga & Dao LAE56630* (AD); Kaisenik, Aug 1977, *Rau 100* (CANB); Bulldog track, Edie Creek, Sep 1964, *Sayers NGF21222* (BRI, CANB, L); Road from Bulolo above Edie Creek, May 1977, *Symon 10638 & Kairo* (AD). Central Province: Boridi, Sep 1935, *Carr 13200* (CANB, L).

***Distribution and habitat*:** *Solanum rivicola* is known from four sites in close proximity in Morobe province, and an outlier 200 km further south in Central province (**Map 4**). Altitude ranges from 1300 to 2900 metres. Habitats include along a freshwater creekline in peaty soil, and in a disturbed montane forest.

***Phenology*:** Flowers are recorded for May and from July to September.

***Notes*:** *Solanum rivicola* is readily distinguished by its strongly recurved prickles on the branchlets, the more or less glabrous upper leaf surface, the filamentous pedicels and the slender corolla lobes.

In the protologue, an isotype is listed for CANB. However, no isotype is present there (B. Lepschi *pers. comm.* Apr 2016).

Symon (1985) included under the name *S. rivicola,* many specimens showing a large range of variation. Most of these specimens are here assigned to *S. exemptum, S. malignum, S. phoberum* or *S. scolophyllum*.

27. Solanum saruwagedense Symon, *J. Adelaide Bot. Gard.* 8: 120 (1985). **Type:** Papua New Guinea. Morobe Province: Along slope of Zaran Creek, SW slope of Mt Enggom, Sarawaket Range, 24 February 1963, *P. Van Royen NGF16142* (holo: LAE *n.v.*; iso: L).

For a description and discussion, see Symon (1985).

28. Solanum scolophyllum A.R.Bean **sp. nov.** With affinity to *S. malignum*, but differing by the sprawling terrestrial habit, the shorter branchlet prickles, the stellate hairs of the branchlets lacking broad conical stalks, and the shorter pedicels. **Typus:** Papua New Guinea. Southern Highlands Province: 3 miles [5 km] from camp site on Mendi Road, Mendi subdistrict, 26 September 1968, *J. Vandenberg, P. Katik & A.Kairo NGF 39796* (holo: BRI; iso: L; LAE *n.v.*).

Terrestrial herb. Sympodia bifoliate, disjunct. Branchlets brown; prickles 10–48 per dm, straight, broad-based, 1–4 mm long, 2–3 times longer than wide, glabrous throughout or rarely with a few stellate hairs attached; branchlet stellate hairs frequent to dense, 0.35–0.7 mm diameter, stalks cylindrical, 0–0.25 mm long; lateral rays 6–8, porrect; central ray 0.3–1.3 times as long as laterals, not gland-tipped; simple hairs absent. Adult leaves elliptical to ovate, entire; lamina 3.5–6.4 cm long, 1.6–2.5 cm wide, 2–2.7 times longer than broad; apex acute to acuminate, base cuneate, oblique part 0–1 mm long, obliqueness index 0–3 percent; petioles 0.6–0.8 cm long, 12–21% length of lamina, prickles present. Upper leaf surface green; prickles present on midvein and lateral veins, 5–34, straight, broad-based, 1.5–6 mm long; stellate hairs distributed throughout, hairs sparse to moderately dense, 0.25–0.45 mm apart, 0.15–0.6 mm across, sessile, lateral rays 4–8, porrect; central ray 0.2–0.8 times as long as laterals, not gland-tipped; simple hairs absent. Lower leaf surface yellowish-green; prickles 4–23, present on midvein and lateral veins; stellate hairs sparse to moderately dense, 0.25–0.9 mm apart, 0.3–0.6 mm diameter, stalks 0–0.1 mm long; lateral rays 4–8, porrect; central ray 0.3–1.5 times as long as laterals, not gland-tipped; simple hairs absent. Inflorescence supra-axillary, unbranched; common peduncle absent or present, 0–4 mm long; rachis present, 1–9 mm long; 2–7-flowered, with all flowers bisexual, 5-merous; pedicels at anthesis 9–14 mm long, 0.3–0.7 mm thick, cylindrical, prickles absent. Calyx tube at anthesis 1–2.5 mm long; calyx lobes at anthesis rostrate, 1–3 mm long; calyx prickles absent; calyx stellae sparse to very dense, yellow, 0.25–0.4 mm across, stalks 0–0.05 mm long, lateral rays 5–8, central ray 0.3–1.5 times as long as laterals, not gland-tipped, simple hairs absent. Corolla white, 9–10 mm long, shallowly or deeply lobed, inner surface glabrous or with dense stellate hairs on distal half; anthers 4–4.5 mm long; functional style *c.* 6 mm long, protruding between anthers, glabrous, stigma entire. Fruiting calyx lobes less than half length of mature fruit, prickles absent; fruits 2–5 per inflorescence, mature fruits not seen; pedicels 23–25 mm long, cylindrical, 0.7–0.8 mm thick at midpoint. Seeds not seen. **Figs. 23, 24.**

***Additional specimens examined*: Papua New Guinea.** Southern Highlands Province: Vicinity of Habono rest house, 6.5 miles [10.5 km] W of Mt Ne, Tari, Aug 1966, *Frodin NGF 32059* (BRI, L); 3 miles [5 km] from camp site on Mendi road, Mendi subdistrict, Sep 1968, *Vandenberg et al. NGF 39796* (BRI, L).

***Distribution and habitat*:** *Solanum scolophyllum* is known from two sites in the Southern Highlands province (**Map 4**), with altitudes between 2100 and 2800 metres. It grows on disturbed sites adjacent to forest.

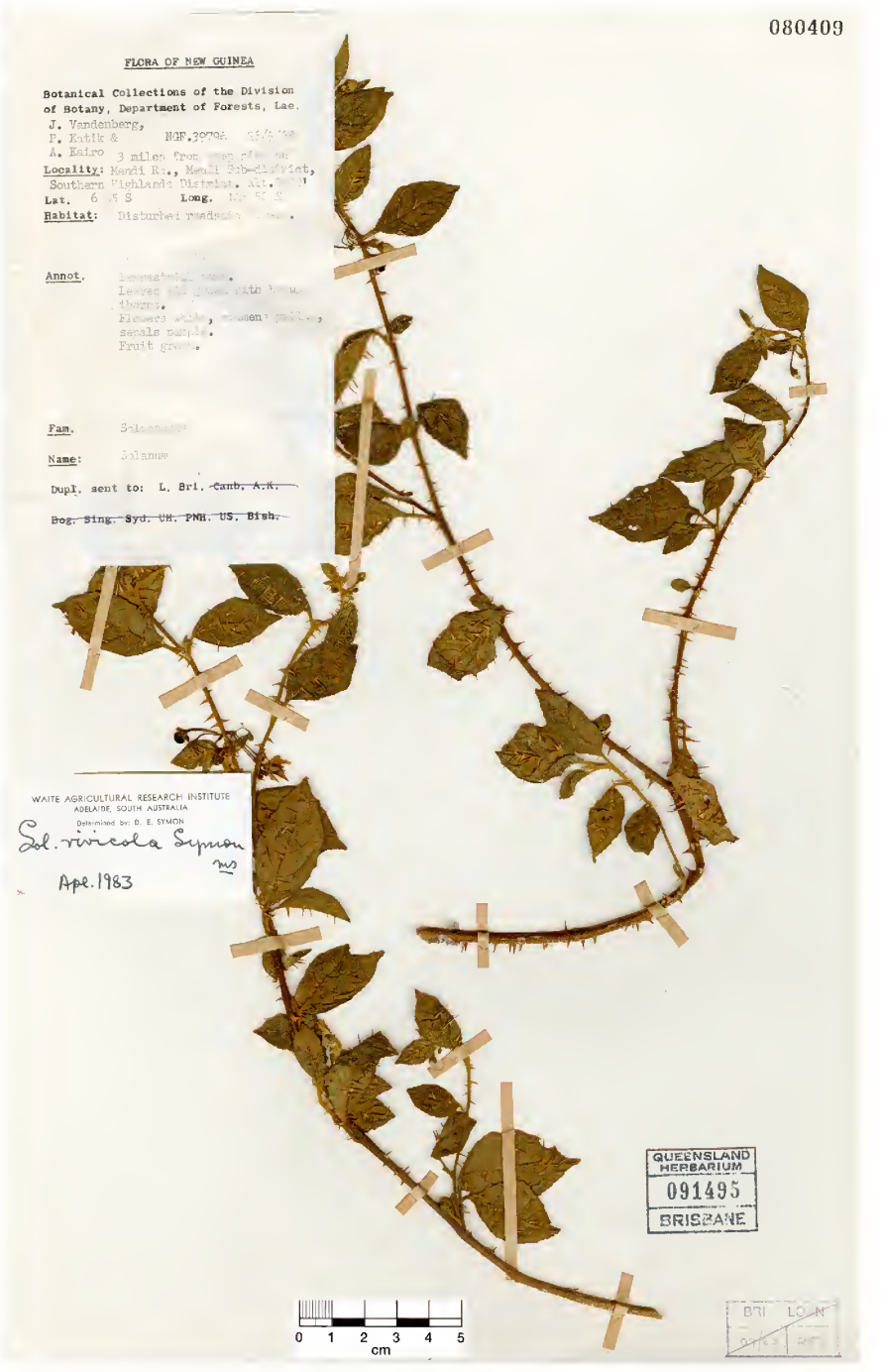

Fig. 23. Holotype of ***Solanum scolophyllum*** (*Vandenberg et al. NGF 39796*, BRI).

***Phenology*:** Flowers and immature fruits are recorded for August and September.

***Notes*:** Specimens cited above as *Solanum scolophyllum* were identified by Symon (1985) as *S. rivicola*. *S. scolophyllum* is similar to *S. malignum* (which occurs about 5 km away), but the latter differs by being an erect shrub with branchlet prickles 5–12 mm long, and by having branchlet stellate hairs with broad conical stalks to 0.6 mm long, and longer pedicels.

The collection *Frodin NGF32059* differs from the type by the fewer prickles on the branchlets and both leaf surfaces, the shorter central ray on the stellate hairs of the branchlets and lower leaves, the dense to very dense hairs on the calyx, the fewer flowers per inflorescence, and the flowers with relatively thick pedicels.

The label for the type specimen refers to the plant as a "terrestrial herb", and it does have all the appearance of a creeping semi-prostrate plant. *Frodin NGF 32059* also has the appearance of a creeping semi-prostrate plant, but the label data include the description "Small tree, height 15 feet", and "lenticels small, raised, numerous". I believe these descriptions apply to some other genus of plant, and that there was a mix-up of labels. There are certainly no lenticels on the *Solanum* specimen.

***Etymology*:** The specific epithet is from the Greek *skolos* 'pointed object, thorn' and *phyllon* 'a leaf'. This is given in reference to the many prickles borne on the upper and lower surfaces of the leaves.

29. Solanum symonianum W.N.Takeuchi, *Edinburgh J. Bot.* 58: 167 (2001). **Type:** Papua New Guinea. Morobe Province: Kamiami Wildlife Management area, Alealer River, W of Sachsen Bay, 15 June 1998, *W. Takeuchi 12027* (holo: L; iso: A, AD, K).

For a description, see Takeuchi (2001).

***Additional specimens examined*: Papua New Guinea.** Morobe Province: Oomsis Creek, *c.* 18 miles [29 km] W of Lae, Mar 1962, *Hartley 10033* (A, BRI); Wagau – Labu track, Mumeng, Mar 2000, *Lovave 69* (A); Garaina area, Saurere track, Wau subdistrict, May 1971, *Stone LAE53462* (A, BRI); Mt Kawea, Buso, Lae subdistrict, Apr 1972, *Streimann & Foreman NGF24441* (A, BRI).

Fig. 24. Inflorescence of ***Solanum scolophyllum*** (*Vandenberg et al. NGF 39796*, BRI).

***Distribution and habitat*:** *Solanum symonianum* is apparently confined to Morobe province (**Map 2**), where it is known from several sites, at altitudes ranging from 120 to 1100 metres. It occurs in a range of habitats including a secondary forest along a stream, a low montane *Castanopsis* forest, and a ridgetop stunted lowland forest on ultrabasic rocks.

***Phenology*:** Flowers and fruits are recorded from March to May.

***Notes*:** Takeuchi (2001) stated *S. symonianum* was known only from the type, but a number of other collections (cited above) are a very good match for the type. Takeuchi (2001) did not compare *S. symonianum* with *S. anfractum*, but that is clearly its closest relative. It is most readily distinguished from *S. anfractum* by the stellate hairs on the lower leaf surface having 4–8 evenly radiate, slender filamentous lateral rays. He referred to *S. symonianum* as an "unarmed liane", but other collectors have called it a shrub.

30. Solanum trichostylum Merr. & L.M.Perry, *J. Arnold Arb.* 30: 47 (1949). **Type:** Papua New Guinea. Central Province: Mt Tafa, September 1933, *L.J. Brass 4934* (holo: A; iso: BRI, NY).

Erect perennial shrub, 1–2 m high. Sympodia bifoliate, geminate. Branchlets brown or rusty; prickles 16–38 per dm, straight, broad-based, 1–2 mm long, 1–2 times longer than wide, with stellate hairs throughout lower part; branchlet stellate hairs dense, 0.2–0.5 mm diameter, stalks 0–0.3 mm long, slender, cylindrical; lateral rays 6–8, porrect; central ray 0.1–0.8 times as long as laterals, not gland-tipped; simple hairs absent. Adult leaves narrowly ovate to ovate or elliptical, entire, 4.5–14.7 cm long, 1.9–5.9 cm wide, 1.9–2.5 times longer than broad; apex acute to acuminate, base cuneate, oblique part 0.5–2.5 mm long, obliqueness index 1–3 percent; petioles 0.7–2.6 cm long, 16–26% length of lamina, prickles present or absent. Upper leaf surface green; prickles absent, or present on midvein only, or on midvein and lateral veins, 0–6, straight, broad-based, 1–4 mm long; stellate hairs distributed throughout, sparse, 0.15–0.4 mm apart, 0.15–0.4 mm across, stalks absent; lateral rays (5–)6–8, porrect; central ray 0.3–3 times as long as laterals, not gland-tipped; simple hairs absent. Lower leaf surface brown to rusty; prickles usually absent or rarely 1 present along midvein; stellate hairs moderately dense, 0.15–0.3 mm apart, 0.35–0.5 mm diameter, stalks 0–0.25 mm long; lateral rays 6–8, porrect; central ray 0.6–2.5 times as long as laterals, not gland-tipped; simple hairs absent. Inflorescence leaf-opposed or supra-axillary, unbranched; common peduncle 0–11 mm long; rachis 1–43 mm long, prickles absent; 6–14-flowered, with all flowers bisexual, 5-merous; pedicels at anthesis 7–16 mm long, 0.5–0.9 mm thick, same thickness throughout, prickles absent. Calyx tube at anthesis 2–2.5 mm long; calyx lobes at anthesis rostrate, 0.5–2.5 mm long; calyx prickles absent; calyx stellae very dense, yellow, 0.25–0.45 mm across, stalks 0–0.2 mm long, lateral rays 6–8, central ray 0.6–2 times as long as laterals, not gland-tipped, simple hairs absent. Corolla purple, 12–14 mm long, shallowly lobed, inner surface with dense stellate hairs; anthers 4.3–5.8 mm long; filaments 1.2–2 mm long; ovary with sparse tiny glandular hairs or with dense stellate hairs; functional style 7–8 mm long, protruding between anthers, with sparse tiny glandular hairs towards base, or with dense stellate hairs except on distal 2–3 mm. Fruiting calyx lobes less than half length of mature fruit, prickles absent; mature fruits 1–7 per inflorescence, globose, *c.* 14 mm diameter, yellow (*Brass 4934*) at maturity; pedicels 21–27 mm long, thicker towards apex, 0.8–1 mm thick at midpoint. Seeds not seen.

***Additional specimens examined*: Papua New Guinea.** Morobe Province: Road above Edie Creek (from Bulolo), subdistrict Wau, May 1977, *Kairo & Symon 10636* (AD, BRI, CANB, L); Above Wau on Edie Creek Road, Jun 1954, *Womersley & van Royen 5909* (BRI, L). Central Province: Murray Pass, Wharton Range, Jul 1933, *Brass 4539* (BRI, L, NY); Mt Tafa, Sep 1933, *Brass 4934* (A, BRI); W slope, Wharton Range, Avios, Jan 1965, *van Royen NGF30154* (A, BRI, CANB, L).

***Distribution and habitat*:** *Solanum trichostylum* occurs in the Mt Tafa – Wharton Range area of Central province, and there is an outlier near Edie Creek in Morobe province (**Map 1**). Recorded altitudes range from 1900 to 2650 metres. It occurs on roadside clearings in forest, secondary regrowth or fire-damaged forest borders.

***Phenology*:** Flowers are recorded for January, May, June, July and September; fruits in May, June, July and September.

***Notes*:** Specimens from the Edie Creek area are not typical as the style and ovary have glandular hairs only, lacking the stellate hairs that are so prominent in the type, and the central ray of the stellate hairs on the leaves is 2–3 times longer than lateral rays (0.3–1.1 times for the typical form).

Acknowledgements

I thank the Directors of A, AD and CANB for sending specimens on loan. I am grateful to Dr Sandra Knapp (BM) for her critical examination of the holotype of *S. turraeifolium*; to Will Smith (BRI) for the specimen images and the editing of the distribution maps.

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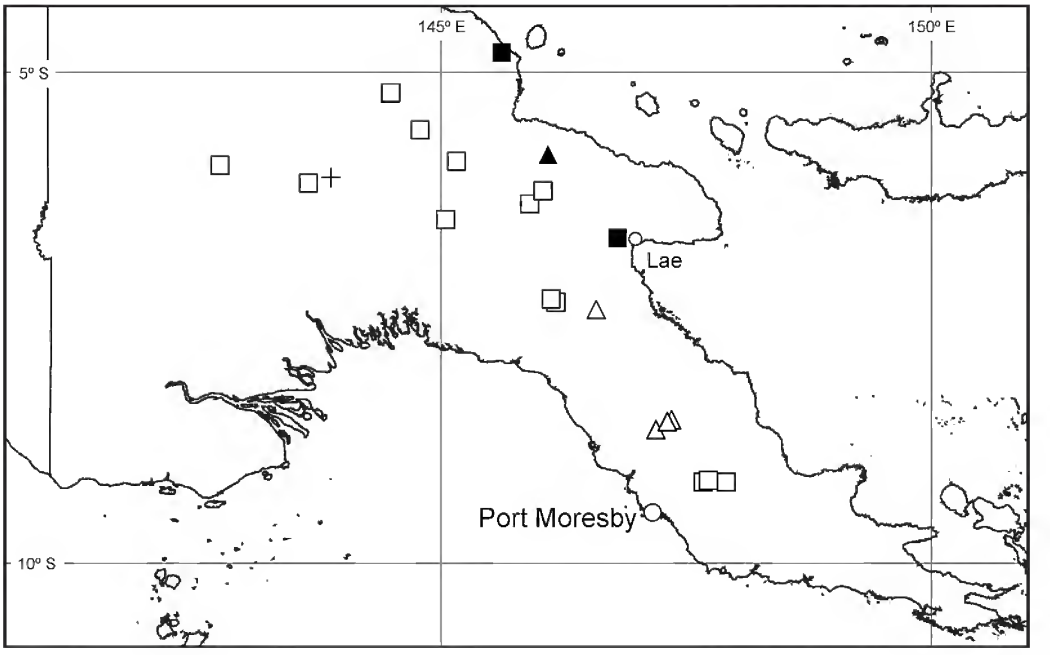
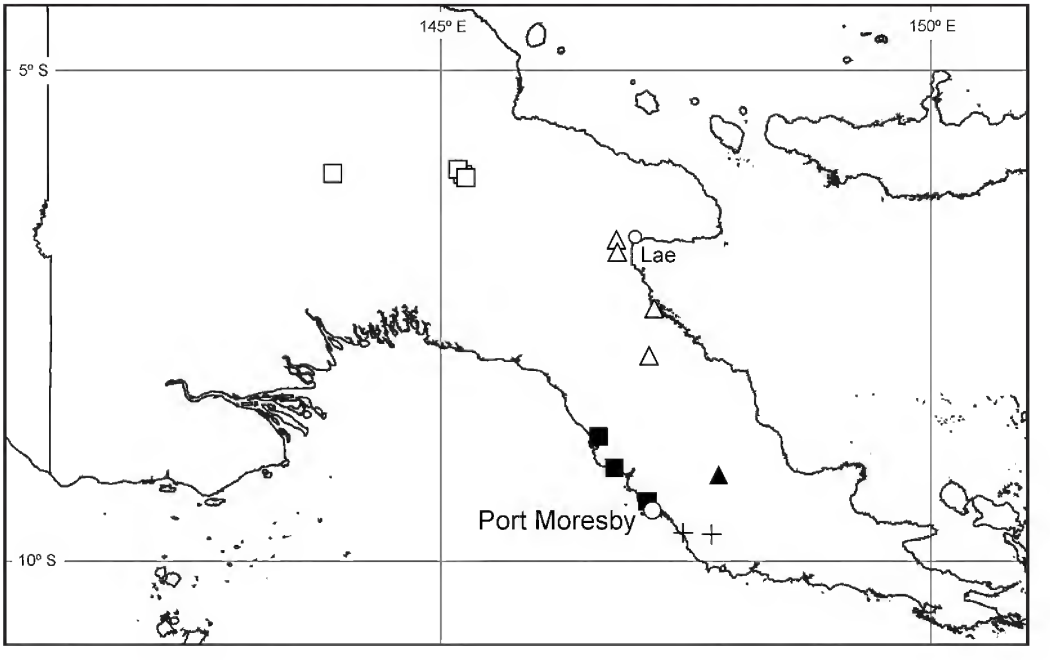
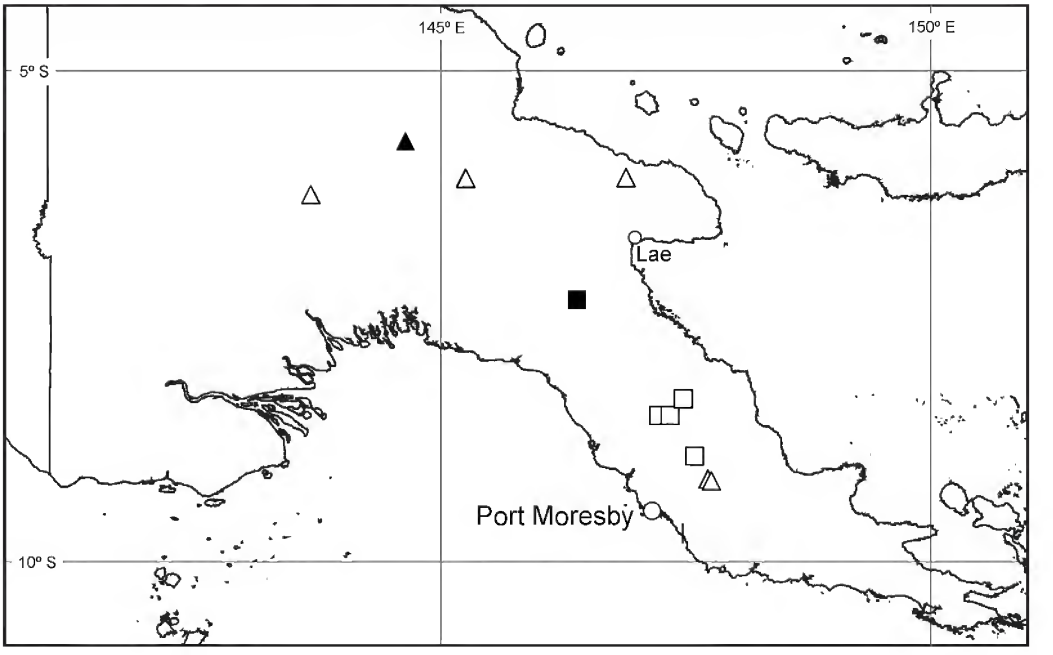


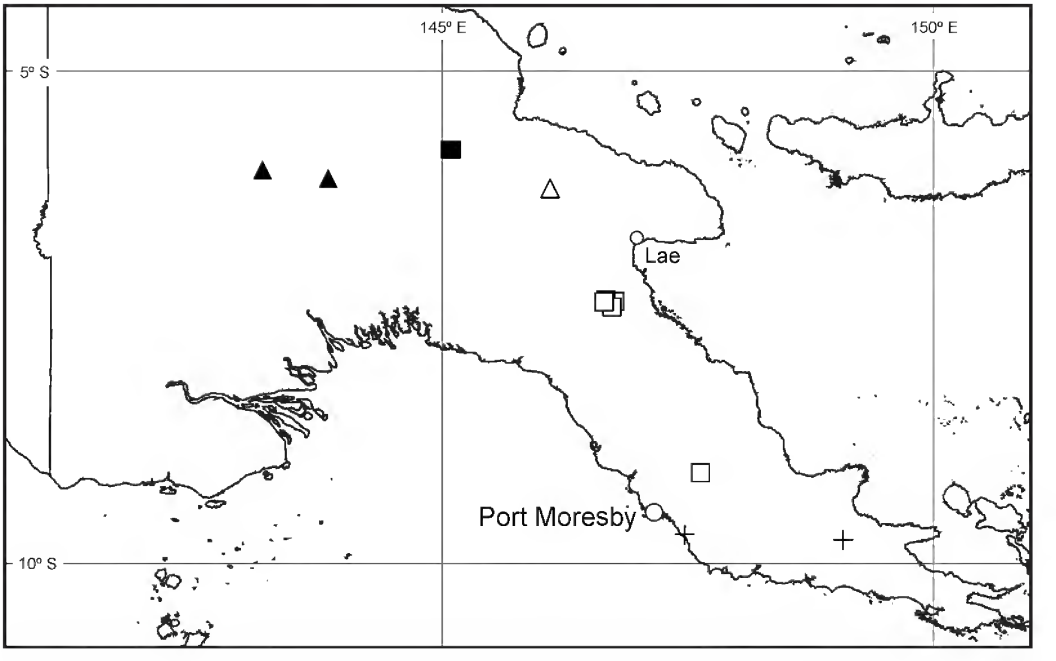
Map 1. Distribution of ***Solanum*** species in New Guinea: ***S. anfractum*** □, ***S. malignum*** +, ***S. oomsis*** ■, ***S. ortivum*** ▲, ***S. trichostylum*** △.



Map 2. Distribution of ***Solanum*** species in New Guinea: ***S. discolor*** ■, ***S. expedunculatum*** □, ***S. fervens*** +, ***S. petilum*** ▲, ***S. symonianum*** △.



Map 3. Distribution of ***Solanum*** species in New Guinea: ***S. arachnoides*** ■, ***S. banzicum*** ▲, ***S. invictum*** □, ***S. papuanum*** △.



Map 4. Distribution of ***Solanum*** species in New Guinea: ***S. exemptum*** +, ***S. phoberum*** ■, ***S. pluriflorum*** △, ***S. rivicola*** □, ***S. scolophyllum*** ▲.

SHORT COMMUNICATION

Austrobaileya C.T.White honours F.M.Bailey

G.P. Guymer

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The name *Austrobaileya* was published by White (April 1933), although he does not mention with his description or elsewhere in this paper the derivation of this name. Johnson (1977) in the Foreword to the first issue of the Queensland Herbarium's scientific journal 'Austrobaileya' stated that the genus *Austrobaileya* "was named in honour of two Baileys, F.M. Bailey the noted Queensland botanist, and I.W. Bailey, USA (S.L. Everist, *pers. comm.*)". However, there is no evidence to support the assumption that the two Baileys were being honoured. C.T. White's first correspondence with I.W. Bailey was in October 1947 (BRI archives letter 4201) when Bailey wrote to him regarding White's collection (*White 10734*, September 1936) of *Austrobaileya* from Mt Spurgeon. Bailey considered White's specimens to be a new species of *Austrobaileya* and White responded to this letter in January 1948 (BRI archives letter 4200) and subsequently published the name *Austrobaileya maculata* for it (White 1948). Ross (1989, 2007) considered *A. maculata* to be conspecific with *A. scandens* and this taxonomy has been accepted.

The evidence that White was only honouring his grandfather F.M. Bailey in naming *Austrobaileya* is also based on an article titled 'Flora of north Queensland' (Anonymous September 1933). The article summarises White (April 1933) and notes that "several new genera were described. One of the most striking is *Austrobaileya*, commemorating the name of the late F.M. Bailey and his work on the Australian flora". White was an active member of The Queensland Naturalist Club and contributor to the Club's journal at the time and it is highly likely he authored this article.

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Referees consulted for *Austrobaileya* Vol. 9

Acceptance of papers has depended on the outcome of review by referees. Those consulted for the current volume are listed below. Several were consulted on more than one occasion. Sincere thanks are extended to all these people whose expertise has helped to maintain journal standards.

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Index of Papers and New Names published in Austrobaileya – Volume 9

Papers

New Names